

NORTH CASCADES ECOREGION



PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The North Cascades ecoregion includes the Cascade Mountains north of Snoqualmie Pass and west of the crest and extends northward into British Columbia. Approximately 10 percent of Washington occurs within this ecoregion. As of 2003, less than two percent of the Washington portion of the ecoregion had been converted to urban and agricultural development. Major rivers in the ecoregion include the Skagit, Stillaguamish, Snohomish and Nooksack. The Skagit is the largest river flowing into Puget Sound. Approximately 240 natural mountain lakes are contained within the rugged landscape of the North Cascades ecoregion.

Geology

The North Cascades is composed of highly dissected, glaciated mountain terrain, mostly between 1000 and 7000 feet above sea level. The highest peaks are volcanoes that rise to more than 10,000 feet. Valley bottoms extend down to as low as 500 feet. Glacially carved U-shaped valleys and cirques are prominent features. Watersheds typically begin as steep-gradient small stream drainages that feed major rivers flowing into the adjacent Puget Trough ecoregion. Natural lakes, most of which were created by glacial processes, are plentiful.

Climate

High precipitation typifies the ecoregion varying from approximately 60 to 160 inches per year. Most precipitation accumulates from October through April as snow and rain. High elevations in the mountains are covered with snow for many months. Middle elevations have significant snowpacks that fluctuate over the course of the winter with rain-on-snow events. Lower elevations within the ecoregion accumulate little snow or have transient snowpacks.

Habitat and Plant Associations

The vegetation of the North Cascades ecoregion in Washington consists mostly of western hemlock/Douglas-fir/western redcedar forests at low elevations, Pacific silver fir/western hemlock forests at middle elevations, and a mosaic of mountain hemlock/silver fir forests and subalpine parkland at high elevations. Natural stand replacement fires occur at irregular intervals of 90 to 250 years. Above timberline, alpine heaths, meadows and fellfields (stony habitats with low mat and cushion plants) are interspersed with barren rock, ice and snow. Special habitats include riparian areas dominated by broadleaf trees, avalanche chutes dominated by Sitka alder or vine maple and wetlands. Rare plant species in this ecoregion are often circumboreal species (species occurring in high northern latitudes around the world) on the southern edge of their range, with populations scattered in the high Cascades.

Fish and Wildlife Diversity

The North Cascades ecoregion has experienced less logging disturbance and development than other regions of the Cascade Mountains and retains high biodiversity, especially in the North Cascades National Park and designated wilderness areas. The region is home to approximately 75 mammal species, 21 species of reptiles and amphibians, roughly 200 species of birds, and at least 28 species of fish. Recent surveys have documented over 500 types of land insects and approximately 250 aquatic invertebrate species. This ecoregion is one of several in Washington that provides important habitat for wide-ranging carnivores including lynx, gray wolves, grizzly bears and wolverines. Salmon inhabit most of the large rivers. The ecoregion hosts a wide variety of breeding birds, including bald eagles, osprey, harlequin ducks and many species of Neotropical migrants.



LAND OWNERSHIP

Major landowners in the North Cascades ecoregion are the National Park Service, the USDA Forest Service (Mt. Baker-Snoqualmie National Forest), Washington Department of Natural Resources, and private timber companies. The private land in the Cascades is a legacy of the 1864 Northern Pacific Land Grant, which bestowed vast amounts of land on the railroad that built a trans-continental link to the Pacific Northwest. The Weyerhaeuser Co. moved into the region, just over a century ago, through a 900,000-acre land sale by railroad baron James J. Hill to his Minnesota neighbor, timber magnate Frederick Weyerhaeuser. The Plum Creek Timber Co. is an independent company, but has its origins as the Burlington Northern subsidiary that managed the company's timber holdings from western Montana to the Washington Cascades.

The North Cascades National Park Service Complex is made up of three park units managed as one: North Cascades National Park and Ross Lake and Lake Chelan National Recreational Areas. Each area contains different ecosystems and wilderness attributes. Most of the park complex, over 93 percent, is managed as the Stephen T. Mather Wilderness, established by Congress in 1988. North Cascades National Park is notable for its large size and strict protection status.

Mt. Baker-Snoqualmie National Forest encompasses a large portion of the remaining westside slopes of the North Cascades ecoregion (1,724,229 acres), about 41% of which is designated wilderness.

Settlement within the remote and rugged North Cascades occurred slowly over many years. Although some towns developed along the North Cascades Highway, a combination of natural and cultural factors prevented the growth of communities of any size in the ecoregion. The difficulties of physical access and the relatively small amount of workable agricultural land were primary deterrents to settlement. In addition, the lack of surveyed lands and the creation of the Washington Forest Reserve in 1887 may also have discouraged individuals from seeking homesteads in the area that is today mostly a national park. Dominant land uses in the North Cascades ecoregion include recreation, forestry and conservation. Figure 21 below maps land ownership classes for the North Cascades ecoregion.

North Cascades Ecoregion

Land Ownership Classes

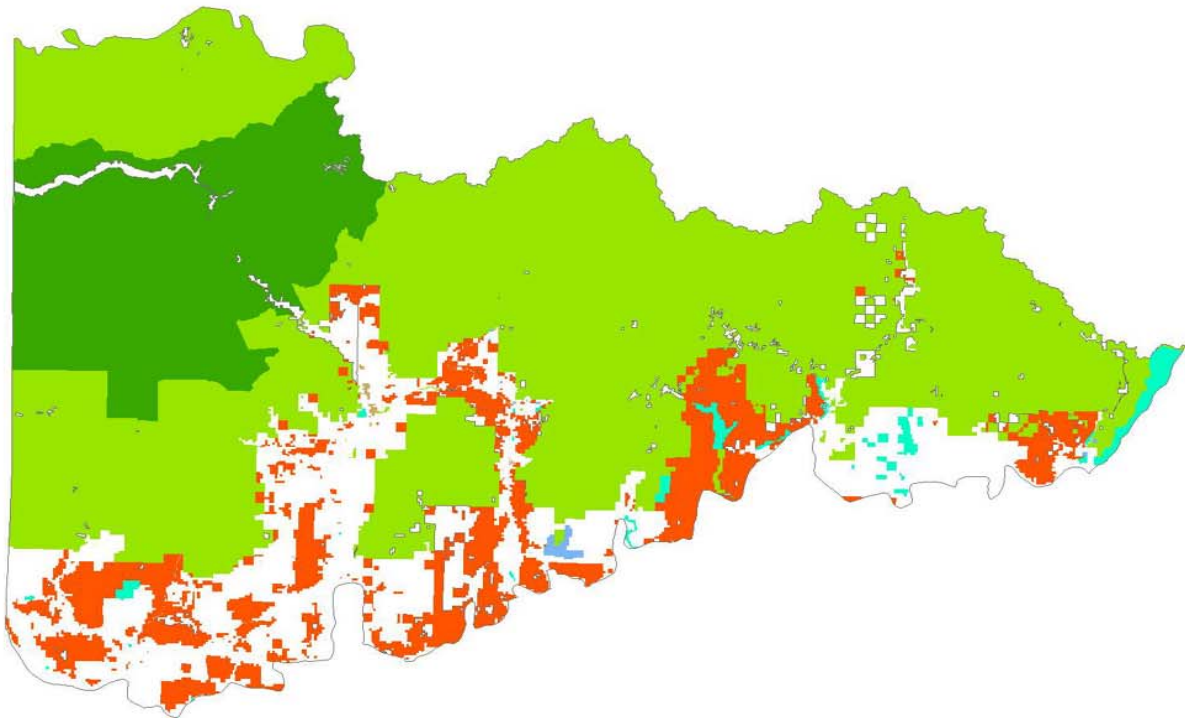
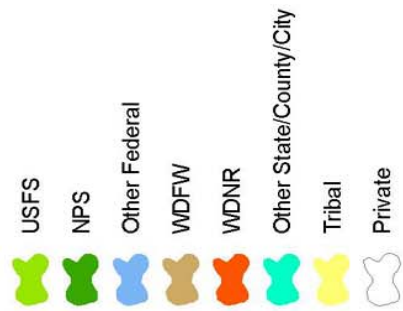


Figure 21.



ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the North Cascades ecoregion include:

- National Park Service
- Seattle City Light
- U.S. Fish & Wildlife Service
- USDA Forest Service (Mt. Baker-Snoqualmie National Forest)
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission
- Whatcom, Skagit, Snohomish, King and Kittitas Counties

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Trust for Public Land, Rocky Mountain Elk Foundation, Audubon Washington, the Grizzly Bear Outreach Project, Northwest Ecosystem Alliance and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the North Cascades ecoregion. Important planning efforts affecting conservation in the North Cascades ecoregion include:

- Mt. Baker-Snoqualmie General Management Plan
- North Cascades Ecoregional Assessment
- North Cascades National Park General Management Plan
- Northwest Forest Plan (1994)
- USFWS Draft Bull Trout Coastal/Puget Sound DPS Recovery Plan (2004)
- USFWS Draft Northern Spotted Owl Recovery Plan (1992)
- USFWS Grizzly Bear Recovery Plan (1993)
- USFWS Marbled Murrelet Recovery Plan (1997)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Common Loon Status Report (2000)
- WDFW Draft North Cascades Regional Wildlife Area Management Plan
- WDFW Fisher Recovery Plan (2005)
- WDFW Fisher Status Report (1998)
- WDFW Game Management Plan (2003)
- WDFW Lynx Recovery Plan (2001)
- WDFW Marbled Murrelet Status Report (1993)
- WDFW North Cascade (Nooksack) Elk Herd Management Plan (2002)
- WDFW Oregon Spotted Frog Recovery Plan (1998)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Pygmy Whitefish Status Report (1998)

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the North Cascades ecoregion.

Species of Greatest Conservation Need

The following species list for the North Cascades ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two, Approach and Methods, as well as in Appendix 3. Species listed below are found in the North Cascades ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Mammals												
Townsend's big-eared bat			x							x	C	S3
Gray wolf	?									x	E	S1
Grizzly bear		x							x		E	S1
Fisher	x							x			E	SH
Wolverine		x						x			C	S1
Lynx			x							x	T	S1
Elk (Nooksack herd, mixed)			x				x				G	S5
Birds												
Common loon			x					x			S	S2
Great blue heron			x							x	M	S4
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Marbled murrelet			x				x				T	S3
Northern spotted owl			x				x				E	S1
Vaux's swift			x				x				C	S3
Pileated woodpecker				x						x	C	S4
Amphibians												
Western toad				x			x				C	S3
Oregon spotted frog			x				x				E	S1

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Columbia spotted frog			x							x	C	S4
Fish												
River lamprey						x				x	C	S2
Pacific lamprey						x				x	N	S3
Bull trout						x				x	C	G3
Salish sucker						x				x	M	S1
Invertebrates												
Beller's ground beetle			x							x	C	S3
Long-horned leaf beetle			x							x	C	
Propertius' duskywing (butterfly)			x				x				M	S3
Johnson's hairstreak (butterfly)						x				x	C	S2

* Status Codes

E = endangered
T = threatened
S = sensitive
C = candidate
M = monitor

** WNHP Codes (S = state, G = global)

1 = critically imperiled
2 = imperiled
3 = vulnerable to extirpation or extinction
4 = apparently secure
5 = demonstrably widespread, abundant and secure

Species Conservation in the North Cascades Ecoregion

Species of Greatest Conservation Need (SGCN) found in the North Cascades ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. Conservation actions are recommended for these SGCN species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

Ecoregional Habitat Overview

Vegetation in the North Cascades ecoregion exhibits relatively high diversity in response to variations in elevation and other conditions. Lower elevation areas tend to be dominated by mature stands of Douglas-fir, western redcedar and western hemlock. Higher elevation species typically comprise mountain hemlock, Pacific silver fir and yellow cedar. Douglas-fir can be found in drier sites, while red alder favors disturbed alluvial sites. About 75 percent of the ecoregion is covered by western lowland and montane coniferous forest habitat. Most of the higher elevation conifer forest is protected in wilderness areas, the North Cascades National Park and the Ross Lake National Recreation Area. Figure 22 below maps wildlife habitat classes in the North Cascades ecoregion.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the North Cascades ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Westside Lowlands Conifer-Hardwood Forest
- Montane Mixed Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Subalpine Parkland
- Alpine Grasslands and Shrublands
- Agriculture, Pasture and Mixed Environs
- Urban and Mixed Environs
- Open Water: Lakes, Rivers and Streams
- Herbaceous Wetlands
- Westside Riparian-Wetlands
- Montane Coniferous Wetlands

North Cascades Ecoregion

Wildlife Habitat Classes

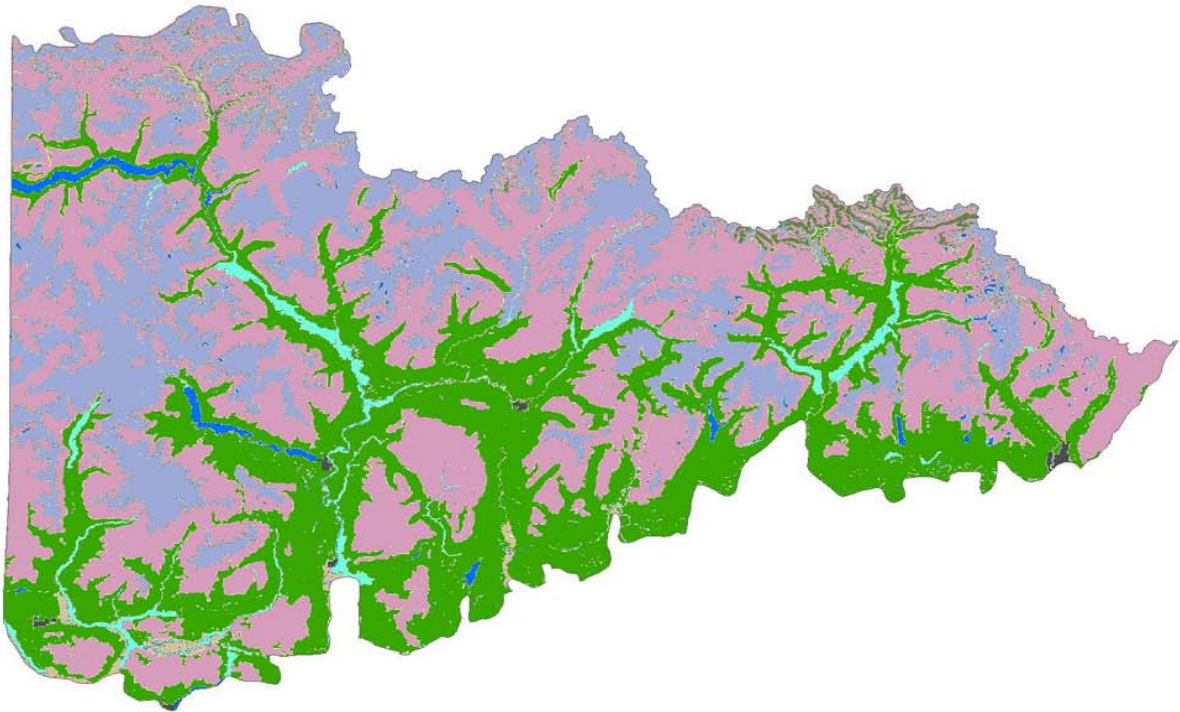
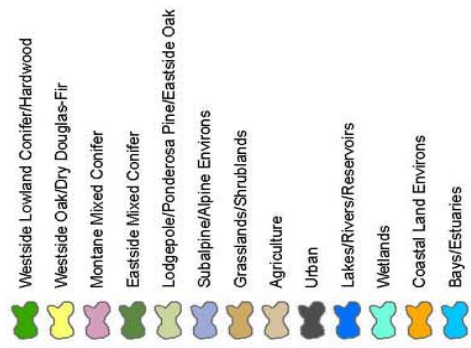


Figure 22.

Priority Habitats in the North Cascades Ecoregion

The following three habitat types have been identified as the highest priority for current conservation action in the North Cascades ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the North Cascades Ecoregional Assessment and the subbasin plans listed in the "Major Plans" section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two: Approach and Methods.

- Westside Lowlands Conifer-Hardwood Forest
- Subalpine Parkland
- Westside Riparian-Wetlands

Westside Lowlands Conifer-Hardwood Forest

This habitat occurs as lowland to low montane forests on the western slopes of the North Cascades. Western hemlock is the most characteristic species; vegetation is also dominated by western redcedar, Douglas-fir, Sitka spruce and red alder. Understory shrub species include salal, dwarf Oregon grape, vine maple, Pacific rhododendron, salmonberry, trailing blackberry, red elderberry, fools huckleberry, oval-leaf huckleberry, evergreen huckleberry and red huckleberry. Sword fern is the most common herbaceous species and is often dominant on nitrogen-rich or moist sites.

Large areas of this forested habitat remain on the west slopes of the North Cascades ecoregion, although only a fraction of the original old growth remains, mostly in the North Cascades National Park. This habitat forms the matrix within which other habitats occur as patches, especially westside riparian-wetlands and, less commonly, herbaceous wetlands and open water. Bordering this habitat at upper elevations is montane mixed conifer forest.

**Selected Species Closely Associated with
Westside Lowlands Conifer-Hardwood Forest
in the North Cascades Ecoregion**

Fisher	Marbled murrelet
Northern spotted owl	Nooksack elk herd
Johnson's hairstreak butterfly	

Subalpine Parkland

Subalpine parkland in the North Cascades occurs at 5000 to 7000 feet in elevation above montane conifer forest or lodgepole pine forest habitat. Associated wetlands in subalpine parklands extend a short distance into the alpine zone. Subalpine habitat generally appears as a mosaic of treeless openings and small patches of trees or as woodlands or savanna-like stands of scattered trees. Herb or shrub-dominated wetlands appear within the parkland areas and are considered as part of this habitat. Fragile plants such as heather, partridge foot and Sitka valerian flourish in high elevation meadows. The parklands include slide alder and false azalea. Numerous alpine and subalpine flowers like phlox, Indian paintbrush, elephant head, columbine, Davidson's penstemon and mountain lupine cover the slopes. Parkland trees are mostly subalpine fir, mountain hemlock, Alaska yellow cedar, and near the eastern edge of the Washington part of the ecoregion, whitebark pine.

**Selected Species Closely Associated
with Subalpine Parkland
in the North Cascades Ecoregion**

Grizzly bear	Wolverine
Nooksack elk herd	

Westside Riparian-Wetlands

Riparian habitat covers a relatively small area in the North Cascades ecoregion, yet it supports a higher diversity and abundance of fish and wildlife than any other habitat in the ecoregion; provides important fish and wildlife breeding habitat, seasonal ranges, and movement corridors; is highly vulnerable to alteration; and has important social values, including water purification, flood control, recreation and aesthetics.

Historically, riparian habitat was limited in the North Cascades, except near the mouths of the river tributaries. Riparian-wetland habitat is characterized by a mosaic of plant communities occurring at irregular intervals along streams and dominated by grass-forbs, shrub thickets and mature forests with tall deciduous trees. Beaver activity and natural flooding are two ecological processes that have affected the quality and distribution of riparian-wetlands in the North Cascades.

**Selected Species Closely Associated with
Westside Riparian-Wetlands and Herbaceous Wetlands
in the North Cascades Ecoregion**

Fisher	Great blue heron
Western toad	Long-horned leaf beetle
Columbia spotted frog	Beller's ground beetle

CONSERVATION PROBLEMS

A number of human activities pose significant potential threats to the integrity of this forest habitat, particularly in valley bottoms. These activities include timber harvest, transportation systems, urbanization, dispersed residential development, mining and hydropower production.

Forest Management Practices

Past forest management practices and related land uses have disrupted or distorted many natural ecosystem functions, which in turn have affected the value and functions of these forests as wildlife habitat. The future condition and value of the ecoregion's terrestrial and aquatic habitats will depend to a large degree on how intensively they are managed for timber and other uses in the future. The Northwest Forest Plan brought major improvements in streamside protections on federal lands. The recent development of the Washington Forest and Fish Agreement has improved the outlook for this habitat type on private lands. However, riparian habitats that were altered and degraded in the past due to logging and road building need restoration.

Wetlands and Riparian Areas

Wetlands and riparian areas are impacted from logging, agriculture, and residential development that affect shorelines, water quality, water quantity, and overall habitat continuity and complexity. This leads to increased erosion, which in turn, increases sedimentation. Uncontrolled livestock grazing compacts soil, contributes to stream bank destabilization, affects compositions of riparian plant communities, and slows recovery of damaged riparian habitat. This loss of riparian vegetation results in greater summer heating and winter cooling of stream temperature, soil instability, reductions in water quantity and quality, and changes in bank, channel and instream structure. All of these habitat changes affect the distribution and abundance of aquatic species.

Hydropower Dams

Hydropower dams on major rivers such as the Skagit, Stillaguamish, Snohomish and Nooksack present a daunting challenge to the upstream and downstream migration of anadromous fish species. Millions of dollars have been and continue to be spent by public agencies and hydropower users to ensure passage of salmon, sturgeon and lamprey through the dams and to otherwise mitigate for the loss of unimpeded migration corridors and habitat. Unless dams are removed from large rivers, which is highly unlikely, the most pressing problems for migrating fish will continue to be caused by the dams, including inadequate fish ladders on some mainstem dams, predation within the mainstem reservoirs from walleye and other fish, nitrogen loading and mortality to downstream migrating juveniles from turbines.

Hydrological diversions and control of natural flooding regimes results in reduced stream flows and reduction of overall area of riparian habitat, loss of vertical stratification in riparian vegetation, and lack of recruitment of young cottonwoods, ash, willows, etc. Hydro projects also destabilize streambanks, narrow stream channels, reduce the flood zone, and reduce the extent of riparian vegetation.

Transportation Systems

Transportation systems impact animals in several ways: roadkill, habitat loss and fragmentation, and hindrance or barrier to movement and migration. When populations are low, roadkill mortality is significant, especially for slow moving turtles and salamanders and wide-ranging carnivores that have to cross many roads. In a fragmented landscape, animals have to move from one patch of habitat to another. When highways fragment landscapes, they divide wildlife populations into smaller, isolated units that are more susceptible to extirpation. Many small roads were built with inadequate culverts that became barriers to fish migration.

Invasive Alien Plants and Animals

Invasive alien plants and animals are a significant threat to biodiversity, second only to habitat loss. They are introduced in a number of ways, including hitchhiking on horses, boats, cars, and trucks, travel on ocean currents, being imported in horticultural products and the pet/aquarium trade, and accidental releases from research institutions and laboratories. Invasive plants displace native vegetation, resulting in the loss of habitat diversity and function. They can severely impact native plant and animal communities and alien grasses and shrubs can add significantly to the fire fuel load, resulting in hotter wildfires that increase damage to native vegetation. The number and abundance of introduced species in an ecoregion is an indicator of declining ecosystem health.

The following additional habitat and species conservation problems have been identified in the North Cascades Ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, and limited population size and distribution.

- Populations of grizzly bear, gray wolf, fisher, lynx, common loon, bald eagle and peregrine falcon have declined to the point that they are listed as endangered, threatened or state sensitive.
- Small population size and loss of genetic diversity are problems for grizzly bear, wolverine, lynx, elk (Nooksack herd, mixed), Beller's ground beetle and long-horned leaf beetle, and are a concern in other species reduced to isolated populations, including Salish sucker.
- Illegal persecution and harvest occurs for bald eagle, gray wolf, grizzly bear, elk (Nooksack herd) and migrating and spawning fish species of concern.
- Bull trout are susceptible to overharvest.

Lack of biological information on species and habitats:

- Adequate information is lacking on the population status of state candidate species including Townsend's big-eared bat, wolverine, northern goshawk, golden eagle, Vaux's swift, pileated woodpecker, western toad, Columbia spotted frog, river lamprey, bull trout, Beller's ground beetle, long-horned leaf beetle and Johnson's hairstreak butterfly.
- Information is needed on habitat associations, demography, and/or food habits for fisher, lynx, pileated woodpecker and Beller's ground beetle.
- Additional distributional data are needed for western toad, bull trout and Beller's ground beetle.

- Information is needed on the causes of decline for elk (Nooksack herd, mixed), western toad, river lamprey and Pacific lamprey.
- Taxonomic relationships between long-horned leaf beetle and closely related species are uncertain.
- Impacts of various land use practices are not understood for Columbia spotted frog.
- Better information is needed on the amount of gene flow among bull trout populations.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

Habitat loss, conversion, fragmentation and degradation:

- Only 3% of western Washington forest is currently in the old growth age class, and nearly all of it is in high elevation national forests or national parks. Maintenance of old growth forest across the landscape is important for at least 1,000 species. Loss and fragmentation of late-successional coniferous forests negatively impacts fisher, northern goshawk, marbled murrelet, northern spotted owl, pileated woodpecker and Johnson's hairstreak butterfly.
- Grassy and herbaceous balds are rare patch habitats distributed in low and high elevation forests. They often have associated rare species that are vulnerable to certain forest practices and recreation.
- Bald eagle, golden eagle, and gray wolf suffer from prey declines linked to habitat loss, degradation and fragmentation.
- Suburban sprawl is a concern for resource managers, as indicated by the growing number of ranchettes and residential subdivisions in previous managed forest and cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.
- Shoreline timber harvest and development may destroy nesting, foraging, or roosting sites for common loon, great blue heron and bald eagle.
- Human development may negatively impact forest habitat for northern goshawk, wintering habitat for elk (Nooksack herd, mixed), and riverine habitat used by Salish sucker.
- Catastrophic large-scale fires reduce the habitat available for lynx.
- Forest clearing may degrade habitat for Townsend's big-eared bat.
- Reclamation of abandoned mines may destroy critical maternity roosts and hibernacula for Townsend's big-eared bat.
- Degradation of bogs harms Beller's ground beetle and long-horned leaf beetle.
- Degradation and elimination of oak groves due to encroachment by Douglas-fir reduces habitat for Propertius' duskywing butterfly.
- Degradation of streams and rivers due to inappropriate forest management, agricultural practices and human development is harmful to bull trout.

Incompatible land management practices:

- Various timber cutting, snag removal and replanting practices have degraded or eliminated habitat for a variety of species including lynx, bald eagle, marbled murrelet, northern spotted owl, Vaux's swift and pileated woodpecker.
- The spraying of forests with Btk to kill tussock moths and budworms has caused population losses in Johnson's hairstreak butterfly.

- Improperly managed grazing has widened stream channels, raised water temperatures, and reduced understory cover.

Alien and invasive plant and animal species:

- Reed canary grass thrives in reservoirs and wetland stream outlets where water levels fluctuate and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other animals are not well adapted to spawn or reproduce in reed canary grass thickets. Many infestations of reed canary grass have been identified at Ross Lake, ranging from individual plants to five-acre patches.
- There is considerable evidence of competition for nesting territories between northern spotted owl and expanding populations of barred owl.
- Predation by introduced bullfrogs and fish negatively impacts Columbia spotted frog.
- Introduced carp and mosquitofish degrade habitat for Columbia spotted frogs.
- Non-native fish such as brook trout pose a threat to bull trout through competition, hybridization and predation.

Human disturbance and recreational impacts:

- Backcountry recreation such as motorized vehicles, hiking, and skiing may disturb or displace grizzly bear, wolverine, lynx, golden eagle and peregrine falcon.
- Recreational boating and fishing may disturb or displace nesting or foraging birds including common loon, great blue heron and bald eagle.
- Human disturbance and vandalism may disrupt the maternity roosts and hibernacula of Townsend's big-eared bat located in caves and mines.
- Encroachment of human development can force golden eagles from suitable nesting sites.
- Nesting peregrine falcons are vulnerable to disturbance from human activities, such as blasting and timber cutting.
- Recreational activities such as offroad recreational vehicles, horses, mountain bikes, and even hikers can create unauthorized trails that disturb soil and allow invasive plants to establish.
- The nature and timing of farm disturbances are increasingly hazardous to wildlife. Tilling, planting and harvesting are more synchronous, widespread and intense, thus stressing wildlife during critical periods of nesting, rearing and dispersal.

Environmental contaminants:

- Ingestion of lead fishing sinkers by common loon and lead shot by bald eagle and golden eagle results in lead poisoning.

Incompatible transportation and energy development:

- Large highway corridors (including Highways 20, 2, and I-90) and associated development fragment suitable habitat and create barriers or impediments to movement for gray wolf, wolverine and lynx.
- Roads may facilitate winter competition between lynx and coyote.
- Roads placed near great blue heron rookeries may result in site abandonment.
- Roads located near breeding sites cause highway mortality in western toad.
- Golden eagle and other raptors can be electrocuted on power lines.

Inadequate water quantity and quality:

- Altered hydrology eliminates habitat for Columbia spotted frog, inland redband trout, Beller's ground beetle and long-horned leaf beetle.
- Increased water temperature and sedimentation caused by logging, agriculture and other activities may harm inland redband trout.
- Dams and other passage barriers limit the movement of river lamprey, Pacific lamprey and bull trout.



CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protect known populations, augmentation and reintroduction of populations, control and monitor mortality, and enhance food/prey.

- Implement recovery actions for grizzly bear, gray wolf, lynx, marbled murrelet, fisher and bull trout.
- Implement the Northwest Forest Plan for managing northern spotted owl habitat.
- Develop management plans for state sensitive species including common loon and peregrine falcon.
- Complete the Washington Bat Conservation Plan.
- Prepare interagency management response guidelines for wolves to document sightings and address conflicts.
- Reduce potential mortality in grizzly bear from accidental shooting by conducting programs to educate bear hunters on proper identification of black bear and grizzly bear.
- Conduct translocations of fisher and elk (Nooksack herd, mixed) into areas of appropriate habitat if indicated by recovery plans and feasibility studies.
- Implement salmon recovery strategies to enhance the prey base for bald eagle.
- Establish and implement fisheries management objectives that are compatible with bull trout recovery.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat, and population trends.

- Monitor populations of lynx, grizzly bear, gray wolf, northern spotted owl and bull trout to determine whether recovery objectives are being met.
- Determine the status of candidate species including Townsend's big-eared bat, wolverine, northern goshawk, golden eagle, Vaux's swift, pileated woodpecker, western toad, Columbia spotted frog, river lamprey, Beller's ground beetle, long-horned leaf beetle and Johnson's hairstreak butterfly.
- Monitor the abundance of Townsend's big-eared bat, northern goshawk, Columbia spotted frog, Salish sucker, Beller's ground beetle, long-horned leaf beetle and Johnson's hairstreak butterfly.
- Monitor post-downlisted populations of peregrine and bald eagle for signs of decline that could result from bioaccumulation of contaminants or other factors.
- Seek and verify reports of incidental sightings of grizzly bear and gray wolf.
- Identify roost sites and hibernacula of Townsend's big-eared bat.
- Conduct habitat selection studies at multiple spatial scales for marbled murrelet, Vaux's swift, Columbia spotted frog, river lamprey, Pacific lamprey and Salish sucker.
- Identify the limiting factors in populations of river lamprey and Pacific lamprey.
- Improve identification methods to distinguish between river lamprey and Pacific lamprey.
- Develop survey protocols to monitor the abundance of great blue heron and Salish sucker.
- Monitor any colonizing wolves to determine establishment of packs and habitat use.
- Evaluate whether existing forest management prescriptions are adequate to maintain populations of lynx and pileated woodpeckers.
- Determine the amount of genetic diversity and gene flow among bull trout populations.
- Investigate the taxonomy of western toad and long-horned leaf beetle using genetic techniques and other analyses.

- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project and other habitat inventories and plans. Update Ecoregional Assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.

Protect, restore and connect habitats:

- Protect rare habitat types such as grassy and herbaceous balds, snag patches, caves, cliffs and talus.
- Maintain mature and late-successional coniferous forests from harvest to protect fisher, northern goshawk, marbled murrelet, northern spotted owl, Vaux's swift and Johnson's hairstreak butterfly.
- Provide input on timber harvest and fire management activities on state, private, and federal lands to perpetuate adequate amounts and distribution of denning and foraging habitats for lynx, and nesting habitat for marbled murrelet.
- Maintain alpine areas and suitable nesting and foraging habitats for golden eagle.
- Protect and restore riparian areas for inland redband trout and bull trout.
- Protect important roost sites and hibernacula for ***Townsend's big-eared bat***.
- Protect suitable breeding lakes for common loon from development and recreational pressure.
- Protect ponds, lakes, creeks and wetland margins used by Columbia spotted frog.
- Protect sites with known populations of Columbia spotted frog.
- Protect land near large great blue heron colonies and known marbled murrelet nesting areas through acquisitions, conservation easements and agreements and management plans.
- Preserve bogs occupied by Beller's ground beetle and long-horned leaf beetle through land purchase, conservation easements and management programs.
- Protect important areas of ungulate winter range through acquisitions, easements and agreements to provide adequate prey populations for gray wolves.
- Manage small fish populations in lakes with nesting common loon.
- Conserve prey populations of golden eagle by reducing deliberate control programs.



- Maintain and enforce Forest Practice rules protecting bald eagle roost sites and nests.
- Continue to require bald eagle habitat plans that require retention of trees.
- Fence fragile bog vegetation to protect populations of Beller's ground beetle and long-horned leaf beetle.
- Maintain oak woodland and understory for Propertius' duskywing butterfly.
- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers and estuaries.

Improve land management practices:

General

- Restore mature and late-successional coniferous forests by encouraging longer harvest rotations and maintaining snags, large trees with cavities, and coarse woody debris to enhance populations of northern goshawk, marbled murrelet and northern spotted owl.
- Promote forest management practices that improve habitat connectivity and facilitate dispersal for grizzly bear, gray wolf, wolverine and lynx.
- Manage land use activities in riparian areas used by inland redband trout.
- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Forest management

- Work with the Forest Practices Board and both public and private forest landowners to properly design and implement current forest practices rules, including the Forests and Fish Agreement to protect fish, wildlife and habitat.
- Protect remaining old growth hardwood and conifer stands to benefit late successional species, and manage some stands on long rotation (>200 years).
- Work through the Washington Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem function. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions. Retain snags, downed woody debris and a complement of live trees in harvested areas. Sensitive areas such as wetlands, remnant old growth and wildlife breeding sites should not be disturbed.
- Encourage the development of selective harvest policies and guidelines on both public and private forestland that will leave adequate components of old growth habitat such as large trees, snags and downed wood as habitat for associated wildlife such as northern goshawk, marbled murrelet, northern spotted owl, Vaux's swift, black-backed woodpecker and pileated woodpecker.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.

Grazing and agricultural practices

- Work with public and tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland and understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use, grazing and soil erosion.

Control and prevent introduction of alien species:

- Develop a regional plan for the detection, rapid response and eradication of invasive species.

- Evaluate the role of timber harvest in promoting the range expansion of barred owl, which interact negatively with northern spotted owl.
- Develop methods to control or otherwise mitigate impacts of introduced bullfrogs and fish on Columbia spotted frog.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout, westslope cutthroat trout, Columbia spotted frogs and other native amphibians and reptiles. Avoid introduction of rainbow trout or only introduce sterile fish where westslope cutthroat are found. Avoid introduction of non-native trout to protect bull trout from hybridization, competition, and predation.
- Monitor lakes, streams and wetlands for illegal fish introductions.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and coordination of weed control efforts on both public and private lands using environmentally sound methods.
- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.

Control and monitor disturbance:

- Limit disruptive types of recreational activity in roadless, wilderness, and primitive areas to prevent disturbance of grizzly bear and wolverine.
- Limit access to roost sites and hibernacula used by Townsend's big-eared bat.
- Minimize disturbance of great blue heron, bald eagle, golden eagle and peregrine falcon nests from human activities such as development, logging, boating, and other recreational activity by restricting access to public lands as needed, working with permitting agencies to reduce levels of disturbance, and informing the public of sensitive areas and periods.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats such as montane wetlands and bogs.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.
- Protect nesting golden eagle, bald eagle and peregrine falcon through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting. Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrine and golden eagle.

Control and prevent environmental contamination:

- Protect common loon, bald eagle and golden eagle from lead poisoning by advocating the use of non-toxic fishing sinkers and steel shot.
- Restrict the use of fish piscicides such as rotenone in waters with common loon.
- Work with other agencies to decrease and remediate sources of contamination to protect bald eagle and peregrine falcon.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments whenever possible, and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.

Improve transportation and energy development:

- Power lines near breeding and foraging areas should be built or modified to reduce the occurrence of golden eagle and other raptor electrocutions.
- Highway overpasses and underpasses should be constructed to facilitate access to suitable habitats for **grizzly bear**, gray wolf and wolverine.
- Reduce road mortality in western toad by providing road crossings near breeding sites.
- Avoid road building near breeding sites for western toad.
- Work with the Washington Department of Transportation to locate highways away from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife that need passage, such as elk (Nooksack herd, mixed) and western toad.



Improve water quantity and quality:

- Provide floating nest platforms for common loon at lakes with fluctuating water levels.
- Conserve beaver populations, beaver ponds and dynamic stream processes in areas with Columbia spotted frogs.
- Reduce the impacts of land use practices that increase water temperature and sedimentation that may harm inland redband trout.
- Identify dams and other passage barriers that limit the movement of river lamprey and Pacific lamprey, and develop methods of passage past such barriers.

- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as conserving beaver populations and dynamic stream processes to benefit species like western toad, Columbia spotted frog and Beller's ground beetle. Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts, or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.

Improve coordination, planning, permitting and mitigation:

- Implement the federal recovery plan for the marbled murrelet.
- Strengthen the Shoreline Management Act to protect bald eagle nesting and roosting sites.
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally-sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, Shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.

- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Represent WDFW's conservation interest on interagency recovery teams and working groups.

Improve enforcement of laws and regulations:

- Enforce existing protections for grizzly bear, gray wolf and bald eagles through vigorous investigation and prosecution.
- Enforce fishing regulations, seasons and stream closures to protect bull trout from fishing pressure.
- Enforce recreational access restrictions on public lands and aquatic areas.

Improve landowner assistance:

- Work with landowners to maintain sufficient foraging habitat, travel corridors and denning sites for lynx.
- Develop, periodically update, and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.
- Work with large and small timber companies and landowners to accomplish habitat conservation through non-regulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity and protect these areas through landowner incentives and other nonregulatory programs. This would assist species such as elk (Nooksack herd, mixed), great blue heron, bald eagle, Vaux's swift, pileated woodpecker, western toad, ***Columbia spotted frog*** and Beller's ground beetle.
- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife, and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.
- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands, shrub-steppe and grassland habitat.



- Promote grant programs to assist landowners with implementation of management plans.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Conduct outreach and education programs to engage the public in conservation programs for many species, including gray wolf and grizzly bear. Continue volunteer programs for monitoring common loon activity at lakes.
- Education programs are needed to curtail recreational pressure on common loon and redhead at suitable breeding lakes.
- Provide educational materials to hunters to prevent accidental mortality and harassment of lynx.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.
- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.



WEST CASCADES ECOREGION



PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The West Cascades ecoregion extends west from the Cascade crest to the Puget lowlands and from Snoqualmie Pass southward to the Columbia Gorge. The Washington portion of the ecoregion encompasses approximately eight percent of the state. As of 1991, less than two percent of the Washington portion of the ecoregion had been converted to urban and/or agricultural use.

Geology

The West Cascades ecoregion consists mostly of highlands modified by montane glaciers and associated riverine valleys. The typical elevation range is 1,000 to 7,000 feet above sea level, with the highest peaks rising to more than 14,000 feet on Mount Rainier and the lowest elevations in the Columbia River Gorge at 50 feet. Isolated volcanic peaks such as Mount St. Helens and associated high plateaus rise above surrounding steep mountain ridges. These mountain peaks were formed primarily from extrusive volcanic activity. Small, steep-gradient streams feed major rivers. Natural lakes are frequent, and most were created by glacial processes and landslides.

Climate

The climate of this ecoregion is wet and relatively mild. Average annual precipitation ranges from about 55 to 140 inches. Most precipitation accumulates from October through April. High elevations in the mountains are continuously covered with snow for months. Middle elevations have significant snow pack that fluctuates over the course of the winter with rain-on-snow events. The lowest elevations accumulate little snow and generally have a transient snow pack.

Habitat and Plant Associations

Conifer forests dominate the vegetation of the West Cascades ecoregion. Douglas-fir/western hemlock forests are typical at low elevations. Middle elevations characteristically have Pacific silver fir, western hemlock, Douglas-fir, and noble fir. High elevations have mountain hemlock/silver fir forests and subalpine parklands. Higher elevations on volcanic peaks support alpine heath, meadows, and fellfields (stony habitats with low mat and cushion plants) among glaciers and rock. Special habitats include riparian areas dominated by broadleaf species, wetlands, grassy balds, and oak woodlands. Areas surrounding Mount Rainier support a few endemic rare plant species, as does the Columbia River Gorge. Both are areas of high plant diversity. The Columbia River Gorge has added biogeographic significance because of the mixing of coastal and interior plant species.

Although portions have been extensively managed for timber harvest, the biodiversity of the West Cascades ecoregion is relatively intact and dominated by natural or semi-natural vegetation. One of Washington's highest concentrations of rare plants occurs in the ecoregion, in the Columbia River Gorge. The southern portion of the ecoregion contains fescue grasslands that attract the mardon skipper, a federal candidate butterfly more commonly associated with the Puget Trough ecoregion.

Fish and Wildlife Diversity

Species richness is not as high in the West Cascades ecoregion as it is in other temperate conifer forests, but the ecoregion is notable for comparatively high amphibian species endemism. Five of the ecoregion's 11 endemic species are amphibians and include the coastal giant salamander, Cascades torrent salamander, Larch Mountain salamander, Van Dyke's salamander and the Cascades frog. Most of these species are closely associated with fast-moving, cold mountain streams. Some of the larger carnivores have been extirpated from the ecoregion, including gray wolf and grizzly bear, while others such as the mountain lion and black bear persist. Mammal species of concern in the ecoregion are the fisher, western gray squirrel, and wolverine. Other important inhabitants include more than 7,000 species of arthropods, as well as terrestrial snails.

Several other species that occur in the West Cascades ecoregion, including the Cascades torrent salamander, chinook salmon, bull trout, northern spotted owl and marbled murrelet, have been the focus of conservation attention because of their close association with declining habitat types such as aquatic areas, seeps, talus slopes, and old growth and riparian forests.



LAND USE AND OWNERSHIP

Approximately 65 percent of the West Cascades ecoregion is publicly owned. The U.S. Forest Service manages approximately 87 percent of the public land, within the Gifford Pinchot National Forest, the Mt. Baker-Snoqualmie National Forest and the Mount St. Helens Volcanic Monument. A significant percentage of the Gifford Pinchot National Forest is within designated wilderness. The Bureau of Land Management manages another seven percent, and the National Park Service another six percent within Mt. Rainier National Park. Most of the remaining public land is managed by the Washington Department of Natural Resources. Outside the Interstate 5 corridor and the greater Vancouver metropolitan area, private timber companies own much of the private land in the West Cascades ecoregion.

“Protected” sites in this ecoregion are primarily contained within the remaining intact habitat blocks discussed above, as well as several late-succession forest reserves administratively protected under the Northwest Forest plan for the northern spotted owl.

Land uses range from intensive forestry to municipal supply watersheds to wilderness. The ecoregion contains Mt. Rainier National Park, Mount St. Helens National Volcanic Monument, and several designated scenic and recreation areas. Lowest elevations frequently are in industrial forest management and small areas of non-industrial private forestry. Small rural communities and dispersed settlements are located in the river valleys. The valleys are also grazed by livestock, produce hay and other crops, and are major travel corridors for tourists and commerce. Figure 23 below maps land ownership classes for the West Cascades ecoregion.

West Cascades Ecoregion

Land Ownership Classes

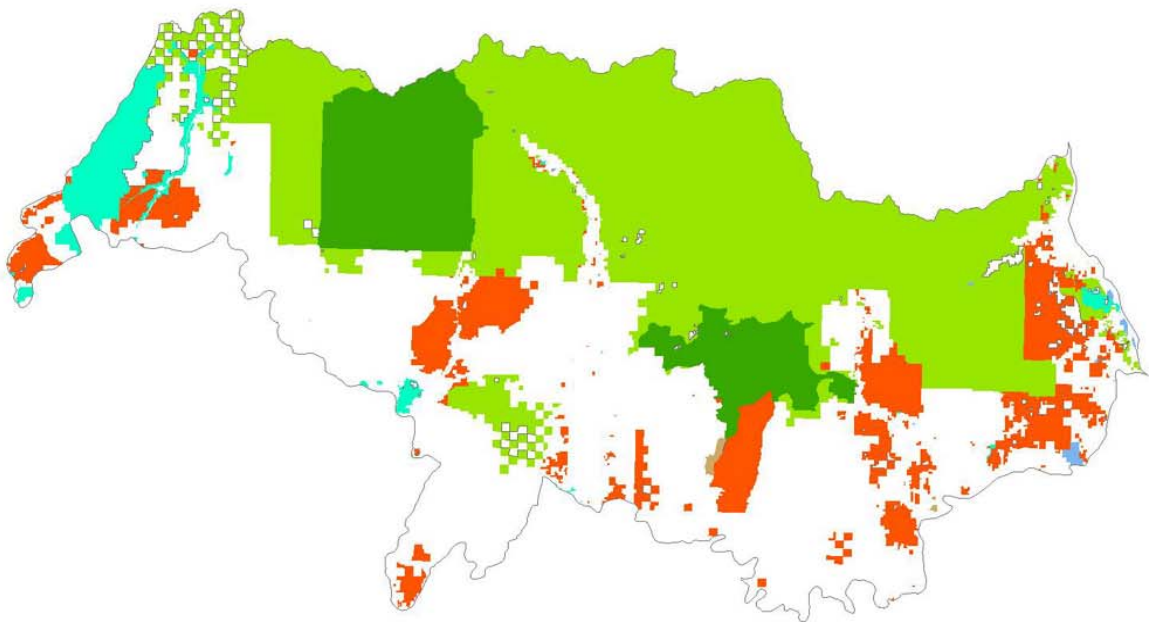
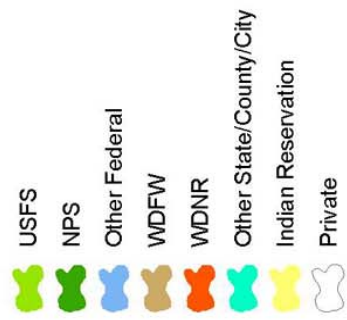


Figure 23.

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the West Cascades ecoregion include:

- National Park Service (Mt. Rainier National Park)
- U.S. Fish and Wildlife Service (Pierce and Franz Lake National Wildlife Refuges)
- U.S. Forest Service (Gifford Pinchot, Mt. Baker-Snoqualmie National Forests, Mount St. Helens National Volcanic Monument, Columbia Gorge National Scenic Area)
- U.S. Army Corps of Engineers
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission
- King, Pierce, Lewis, Skamania and Cowlitz Counties

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Audubon Washington, Ducks Unlimited, the Pacific Coast Joint Venture, and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the West Cascades ecoregion. Important planning efforts affecting conservation in the West Cascades ecoregion include:

- Cowlitz and Lewis Subbasin Plans (2004)
- Northwest Forest Plan (1994)
- USFWS Draft Bull Trout Coastal/Puget Sound DPS Recovery Plan (2004)
- USFWS Draft Northern Spotted Owl Recovery Plan (1992)
- USFWS Marbled Murrelet Recovery Plan (1997)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Draft West Cascades Regional Wildlife Area Management Plan
- WDFW Fisher Recovery Plan (2005)
- WDFW Game Management Plan (2003)
- WDFW Larch Mountain Salamander Status Report (1993)
- WDFW Marbled Murrelet Status Report (1993)
- WDFW Mardon Skipper Status Report (1999)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Western Gray Squirrel Recovery Plan (2005)
- WDFW Western Pond Turtle Recovery Plan (1999)
- West Cascades Ecoregional Assessment

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the West Cascades ecoregion.

Species of Greatest Conservation Need

The following species list for the West Cascades ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two: Approach and Methods, as well as in Appendix 3. Species listed below are found in the West Cascades ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Mammals												
Townsend's big-eared bat			x							x	C	S3
Western gray squirrel			x				x				T	S2
Fisher	x							x			E	SH
Wolverine		x						x			C	S1
Birds												
Common loon			x					x			S	S2
Western grebe			x				x				C	S3
Great blue heron			x							x	M	S4
Northern pintail					x		x				G	S3
Lesser scaup				x			x				G	S4
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Marbled murrelet			x				x				T	S3
Yellow-billed cuckoo	?									x	C	SH
Northern spotted owl			x				x				E	S1
Vaux's swift			x				x				C	S3
Pileated woodpecker				x						x	C	S4
Slender-billed white-breasted nuthatch		x					x				N	S1

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Western bluebird			x				x				M	S3
Reptiles												
Western pond turtle			x						x		E	S1
California mountain kingsnake			x							x	C	S1
Amphibians												
Larch Mountain salamander			x							x	S	S3
Van Dyke's salamander			x							x	C	S3
Cascade torrent salamander				x						x	C	S3
Western toad				x			x				C	S3
Fish												
River lamprey						x				x	C	S2
Pacific lamprey						x				x	N	S3
Green sturgeon				x			x				G	S2
Bull trout						x				x	C	G3
Lower Columbia steelhead											C	G5
Lower Columbia coho											G	G4
Pygmy whitefish						x				x	S	S1
Eulachon		?								x	C	S4
Leopard dace						x				x	C	S2
Mountain sucker						x				x	C	S2
Salish sucker						x				x	M	S1
Invertebrates												
Propertius' duskywing (butterfly)			x				x				M	S3
Mardon skipper (butterfly)		x								x	E	S1
Chinquapin hairstreak (butterfly)			x							x	C	S1
Johnson's hairstreak (butterfly)						x				x	C	S2
Puget Sound fritillary (butterfly)						x	x				N	S3
Valley silverspot (butterfly)			x				x				C	S2
Taylor's checkerspot (butterfly)		x					x				C	S1
Pacific clubtail (dragonfly)			x							x	N	S1
Winged floater (bivalve)			x				x				N	G3
Oregon floater (bivalve)			x				x				N	S3
Western ridged mussel			x				x				N	S2

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Western pearlshell				x			x				N	S4
Bluegray tailedropper (slug)		x					x				N	S4
Oregon megomphix (snail)			x				x				N	G2

* Status Codes

E = endangered
T = threatened
S = sensitive
C = candidate
M = monitor

** WNHP Codes (S = state, G = global)

1 = critically imperiled
2 = imperiled
3 = vulnerable to extirpation or extinction
4 = apparently secure
5 = demonstrably widespread, abundant and secure

Species Conservation in the West Cascades Ecoregion

Species of Greatest Conservation Need (SGCN) found in the West Cascades ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. Conservation actions are recommended for these species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

Ecoregional Habitat Overview

The most widespread low elevation forest type (below approximately 3,300 feet) is dominated by Douglas-fir and western hemlock. Some of the lower valleys contain bottomland hardwoods and oak savannas, but these special community types have suffered serious declines. Western red cedar is common in river drainages. Many of the waterways are flanked with broadleaf hardwood species such as bigleaf maple, black cottonwood, and red alder. If not converted to agriculture or urban development, most of these communities have been degraded by alien species. Many of these areas are now being dominated by Douglas-fir forest. Silver fir and mountain hemlock dominate most forests at mid-elevations. At high elevations, parklands and alpine meadows and barrens predominate. Mountain glaciers persist on many of the higher volcanic peaks, including Mount Rainier and Mt. St. Helens. Figure 24 below maps wildlife habitat classes in the West Cascades ecoregion.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the West Cascades ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Westside Lowlands Conifer-Hardwood Forest
- Westside Oak and Dry Douglas-fir Forest and Woodlands
- Montane Mixed Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine and Eastside White Oak Forest and Woodlands
- Subalpine Parkland
- Alpine Grasslands and Shrublands
- Westside Grasslands
- Agriculture, Pasture and Mixed Environs
- Urban and Mixed Environs
- Open Water: Lakes, Rivers, Streams
- Herbaceous Wetlands
- Westside Riparian-Wetlands
- Montane Coniferous Wetlands

West Cascades Ecoregion

Wildlife Habitat Classes

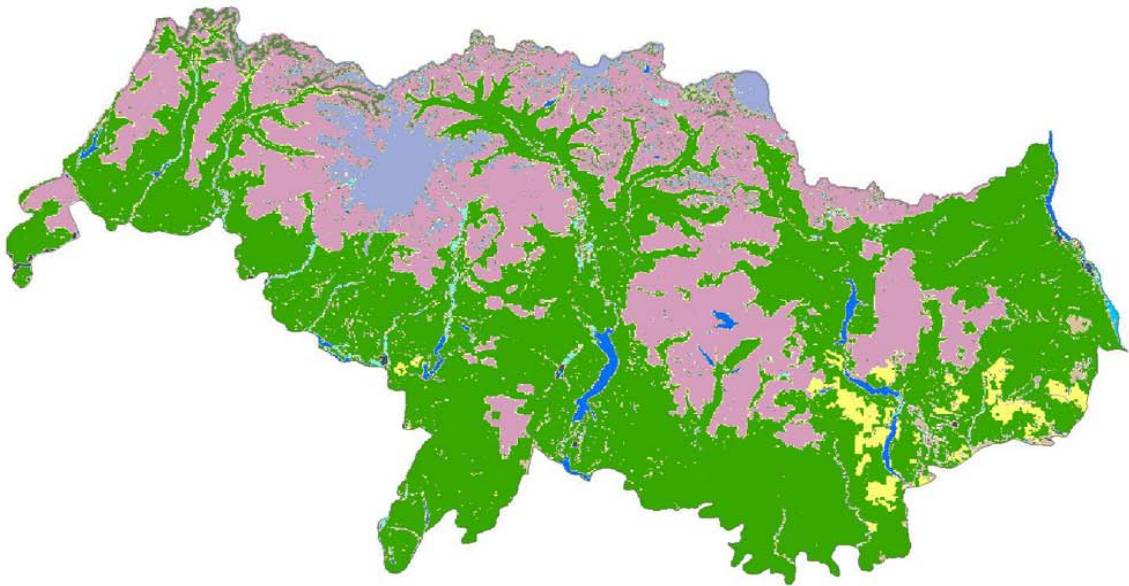
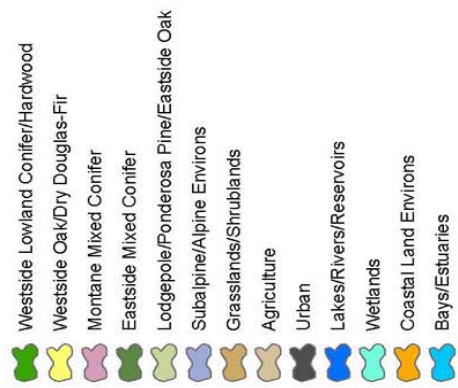


Figure 24



Priority Habitats in the West Cascades Ecoregion

The following four habitat types have been identified as the highest priority for current conservation action in the West Cascades ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the West Cascades Ecoregional Assessment and the subbasin plans listed in the “Major Plans” section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two, Approach and Methods.

- Westside Lowlands Conifer-Hardwood Forest
- Westside Oak and Dry Douglas-fir Forest and Woodlands
- Westside Grasslands (Herbaceous Balds)
- Westside Riparian-Wetlands

Westside Lowlands Conifer-Hardwood Forest

Westside lowland conifer-hardwood forests comprise the major low montane forests of the West Cascades ecoregion. This habitat type occurs throughout low-elevation areas, except on extremely dry sites. These forests occur in moist to wet habitats and microhabitats and are characterized by more moisture-loving undergrowth species, wet to nearly saturated soils, high abundance of shade- and moisture-tolerant canopy trees, and higher stand productivity. Topography ranges from relatively flat glacial till plains to steep mountainous terrain. This is the most extensive forest in the lowlands on the west side of the Cascades. Other habitat types, especially riparian-wetlands, occur as patches within conifer-hardwood forests.

Lowland conifer-hardwood forests are also found on alluvial floodplains that are confined by valleys and inlets. Dominant broadleaf species are bigleaf maple, red alder, black cottonwood, Sitka willow, red-osier dogwood, and Oregon ash. Conifers tend to increase with succession (i.e. over time) in the absence of major disturbance. Conifer-dominated floodplains are now very rare and not well described; grand fir, Douglas-fir, Sitka spruce and western redcedar are important. Riverine flooding and the succession that occurs after major flooding events are the major natural processes that drive this system. Very early successional stages can be sparsely vegetated or dominated by herbaceous vegetation.

The river bottom valleys and low-elevation forests where conifer-hardwood habitats are found are mostly absent from the existing network of conservation lands. The major exception is the Columbia River Gorge, where a national scenic area managed by the USDA Forest Service includes habitat for high numbers of rare and endemic species.

The West Cascades ecoregion contains one of the few remaining concentrations of old growth conifer-hardwood forest in the state. Old growth forests are of national and global importance because they provide some of the last refugia for species dependent on this habitat type, and perform vital ecological roles, including sequestration of carbon, cleansing of atmospheric pollutants, and maintenance of hydrological regimes.

**Selected Species Closely Associated with
Western Lowlands Conifer-Hardwood Forest
in the West Cascades Ecoregion**

Northern spotted owl	Bluegray tailedropper (slug)
Fisher	Oregon megomphix (snail)
Marbled murrelet	

Westside Oak and Dry Douglas-fir Forest and Woodlands

Westside oak and dry Douglas-fir habitat is associated with dry sites or sites with a low-intensity fire regime that was more common before European settlement. The dry sites are typically either shallow bedrock soils or deep gravelly glacial outwash soils. Originally, the vegetation was a woodland or forest dominated by deciduous broadleaf trees, mostly Oregon white oak. This habitat varies between small patch and large patch in its dynamics. Succession in the absence of fire tends to favor increased shrub dominance in the understory, increased tree density, and increased importance of conifers, with the end result being conversion to a conifer forest.

**Selected Species Closely Associated with
Western Oak and Dry Douglas-fir
in the West Cascades Ecoregion**

Western gray squirrel	Propertius' duskywing butterfly
Pileated woodpecker	Johnson's hairstreak butterfly

Westside Grasslands (Herbaceous Balds)

Herbaceous balds are the driest environmental settings within the ecoregion that support continuous vegetation: generally south- to west-facing slopes on shallow or sandy/gravelly soils. They typically occur as isolated sites within a forest matrix. Fire was probably an important process historically on most of these sites, and some of them are threatened by invasion of trees in the absence of disturbance. Vegetation is dominated by perennial bunch grasses, forbs, and mosses. Scattered trees, especially Douglas-fir, are often present. These balds are often rimmed by Oregon white oak stands and provide important transitional habitat for a variety of bird and butterfly species.

**Selected Species Closely Associated
with Westside Grasslands
in the West Cascades Ecoregion**

Western bluebird	Valley silverspot butterfly
California mountain kingsnake	Mardon skipper butterfly
Puget Sound fritillary butterfly	

Westside Riparian-Wetlands

In the West Cascades ecoregion, this habitat is often interspersed within a mosaic of Westside Lowlands Conifer-Hardwood Forest. This habitat also can include Herbaceous Wetlands and occur adjacent to Open Water habitats. Riparian-wetland habitats are a conservation priority because of their importance for a wide range of terrestrial and aquatic species.

Riparian habitats in the West Cascades ecoregion are composed of vegetation in various stages of development depending on the time since the last disturbance. Riparian plant communities vary depending on the upland plant communities, stream gradient, elevation, soil, aspect, topography, and water quality and quantity. In many cases, riparian corridors in agricultural and urbanized settings within previously forested environments are highly altered. Typically, they appear as narrow strips of shrubs and deciduous trees in non-forested landscapes. Many natural streams have been channelized into drainage or irrigation ditches. Where trees have been removed, banks and channels are often choked with reed canary grass, an aggressive alien plant that reduces plant and wildlife diversity and blocks streams, which can impede fish passage.

**Selected Species Closely Associated with
Westside Riparian-Wetlands
in the West Cascades Ecoregion**

Western toad	Van Dyke's salamander
Great blue heron	Cascade torrent salamander
Western pond turtle	Fisher

CONSERVATION PROBLEMS

The majority of the protected lands in the West Cascades ecoregion occur at higher elevations. Most of the natural ecosystems found at lower elevations have been largely destroyed or degraded. Dispersed development in the valleys and the spread of alien species are other significant threats to the conifer-hardwood forests of the West Cascades.

Past Forest Management Practices

Past forest management practices and related land uses have disrupted or distorted many natural ecosystem functions, which in turn have affected the value and functions of these forests as wildlife habitat. The future condition and value of the ecoregion's terrestrial and aquatic habitats will depend to a large degree on how intensively they are managed for timber and other uses in the future. The Northwest Forest Plan brought major improvements in streamside protections on federal lands. The recent Washington Forest and Fish Agreement has improved the outlook for this habitat type on private lands. However, riparian habitats that were altered and degraded in the past due to logging and road building need restoration.

Habitat Fragmentation

Habitat fragmentation in the West Cascades ecoregion is generally greatest in the lower elevations and on private lands. Ownership of lower elevation forests is patchy, hindering coordinated management of public and private lands to address conservation needs.

Past timber harvest has reduced the structural complexity of these forests and reduced the abundance of large woody debris, as well as facilitated introduction of invasive plant species.

In the Columbia Gorge, widespread conversion of oak savannas and woodlands has been severe, and many of them have already been destroyed or degraded. Oak savannas and woodlands are likely to continue to decline because of the difficulties involved in restoring natural fire regimes and because privately owned areas are under considerable threat from further logging, conversion to agriculture, and residential development.

Invasive Alien Plants and Animals

Invasive alien plants and animals are a significant threat to biodiversity, second only to habitat loss. They are introduced in a number of ways, including hitchhiking on horses, boats, cars, trucks, being imported in horticultural products and the pet/aquarium trade, through accidental releases from research institutions and laboratories. Invasive plants displace native vegetation, resulting in the loss of habitat diversity and function. They can severely impact native plant and animal communities and alien grasses and shrubs can add significantly to the fire fuel load, resulting in hotter wildfires that increase damage to native vegetation. The number and abundance of introduced species in an ecoregion is an indicator of declining ecosystem health.

Transportation Systems

Transportation systems impact animals in several ways: roadkill, habitat loss and fragmentation, and hindrance or barrier to movement and migration. When populations are low, roadkill mortality is significant, especially for slow moving turtles and salamanders and wide-ranging carnivores that have to cross many roads. In a fragmented landscape animals have to move from one patch of habitat to another. When highways fragment landscapes, they divide wildlife populations into smaller, isolated units that are more susceptible to extirpation. Historically, construction of logging roads near streams or across wetlands was often extremely destructive to fish and wildlife habitat. Although modern forest practices under state and federal rules are much more likely to provide some protection for wetlands, there are still potential adverse impacts from construction and operation of logging roads. This occurs even when they are located along benches and ridgelines away from riparian zones. Improperly located, constructed or maintained logging roads may trigger or accelerate slope failure, erode stream channels, block fish migration and deposit sediment into streams and wetlands.

Hydropower Dams

Hydropower dams on major rivers present a daunting challenge to the upstream and downstream migration of anadromous fish species. Millions of dollars have been and continue to be spent by public agencies and hydropower users to ensure passage of salmon, sturgeon and lamprey through the dams and to otherwise mitigate for the loss of unimpeded migration corridors and habitat. Unless dams are removed from large rivers, which is highly unlikely, the most pressing problems for migrating fish will continue to be caused by the dams, including inadequate fish ladders on some mainstem dams, predation within the mainstem reservoirs from walleye and other fish, nitrogen loading and mortality to downstream migrating juveniles from turbines.

Hydrological diversions and control of natural flooding regimes results in reduced stream flows and reduction of overall area of riparian habitat, loss of vertical stratification in riparian vegetation, and lack of recruitment of young cottonwoods, ash, willows, etc. Hydro projects also destabilize streambanks, narrow stream channels, reduce the flood zone, and reduce the extent of riparian vegetation. The loss of riparian vegetation has resulted in greater summer heating and winter cooling, soil instability, reductions in water quantity and quality, and changes in bank, channel and instream structure.

The following additional habitat and species conservation problems have been identified in the West Cascades Ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, limited population size and distribution.

- Populations of western pond turtle, fisher, grizzly bear, gray wolf, marbled murrelet, northern spotted owl, and mardon skipper, have declined to the point where they are listed as threatened or endangered. Fisher, grizzly bear, and gray wolf are believed to be extinct in the West Cascades.
- Recovery plans are needed to guide conservation actions for threatened or endangered species including gray wolf and mardon skipper.

- Wolves are expected to re-colonize forested parts of the state, and interagency management response guidelines are needed.
- Management plans are needed for the sensitive species including common loon, peregrine falcon, Larch Mountain salamander and pygmy whitefish. State sensitive species need to be managed to avoid becoming threatened or endangered.
- Many species are only found at a small number of isolated sites and are at risk of local extinction or loss of genetic diversity, including wolverine, western pond turtle, California mountain kingsnake, Larch Mountain salamander, Van Dyke's salamander, mardon skipper, pygmy whitefish, Taylor's checkerspot, Pacific clubtail, and blue-gray tailed darter.
- Overharvest is a problem for green sturgeon and bull trout. Quantitative stock assessment and annual estimate of the total stock size of eulachon is needed in order to estimate the harvest rate.
- Sudden oak death syndrome may become established in Washington, threatening oak woodlands and many oak-dependent wildlife species.
- Illegal persecution and harvest occurs for bald eagle, California mountain kingsnake, and migrating and spawning fish species of concern.

Lack of biological information on species and habitats:

- Data are needed on population trend in state threatened and endangered species including western gray squirrel, western pond turtle, northern spotted owl, marbled murrelet, and mardon skipper.
- Information is needed about the status of populations of state candidate species including Townsend's big-eared bat, wolverine, Vaux's swift, pileated woodpecker, slender-billed white-breasted nuthatch, northern goshawk, golden eagle, California mountain kingsnake, western toad, Van Dyke's salamander, Cascade torrent salamander, mountain sucker, leopard dace, river lamprey, bull trout, eulachon, chinquapin hairstreak, Taylor's checkerspot, Johnson's hairstreak, valley silverspot and yellow-billed cuckoo.
- Information is needed on the current distribution and abundance of Salish sucker, green sturgeon, Pacific lamprey, Propertius' duskywing, Puget Sound fritillary, Pacific clubtail, winged floater, Oregon floater, western ridged mussel, western pearlshell, blue-gray tailed darter, and Oregon megarhine.
- Research is needed on habitat needs, limiting factors, demographics and dispersal in Taylor's checkerspot and mardon skipper to facilitate reintroductions.
- Populations of the peregrine falcon, which has been downlisted to sensitive, and bald eagle, which may soon be downlisted to sensitive, need to be monitored to confirm their continued recovery.
- Suitable ponds for reintroductions of western pond turtle need to be identified.
- Taxonomic and/or genetic work needs include: formally describe Salish sucker; western toad taxonomy is uncertain; thus one or more taxa may be in greater decline; data is needed on genetic diversity and gene flow in bull trout populations.
- Information is needed on the population dynamics and the impact of dredging on the spawning grounds, incubating eggs, and larvae of eulachon.
- The causes of decline of western toad and eulachon are unknown.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

Habitat loss, conversion, fragmentation and degradation:

- Only 3% of western Washington forest is currently in the old growth age class, and nearly all of it is in high elevation national forests or national parks. Maintenance of old growth forest across the landscape is important for at least 1,000 species.
- Grassy and herbaceous balds are rare patch habitats distributed in low and high elevation forests. They often have associated rare species that are vulnerable to certain forest practices and recreation.
- Grassland conversion, recreational use, and rural development may result in loss or degradation of habitat of mardon skipper, Taylor's checkerspot, Puget Sound fritillary, and valley silverspot.
- Loss, fragmentation and degradation of oak and mixed oak/conifer habitats to encroachment by conifers and development affect Propertius' duskywing, slender-billed white-breasted nuthatch, and other oak-dependent wildlife.
- Suburban sprawl is a concern for resource managers, as indicated by the growing number of ranchettes and residential subdivisions in previous managed forest and cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.
- Degradation of shorelines by residential development can eliminate nesting habitat for common loon and bald eagle.
- Larch Mountain salamander are vulnerable to disturbance to rock and talus, woody debris, and moisture regime
- Closing off of abandoned mines may destroy hibernacula and roost sites of Townsend's big-eared bat.

Incompatible land management practices:

- Logging of mature/old timber and reduction in abundance of snags negatively impacts populations of northern spotted owl, marbled murrelet, northern goshawk, Vaux's swift and pileated woodpecker.
- Blue-gray tailed dropper and Oregon megalomphix have apparently declined due to degradation of moist forest floor conditions and loss of coarse woody debris in stands of bigleaf maple or mixed hardwood-conifer stands.
- Logging of old growth and reduction in occurrence of mistletoe likely affects Johnson's hairstreak.
- Improperly managed grazing may impact habitat of mardon skipper, Taylor's checkerspot, valley silverspot and Puget Sound fritillary.
- Lack of fire on grassland allows invasion by Douglas-fir, shrubs, and non-native vegetation, degrading habitat of mardon skipper, Taylor's checkerspot, Puget Sound fritillary and valley silverspot.
- Logging, agriculture, road building or other activities that elevate temperature, alter hydrology and increased sedimentation may degrade habitat of Cascade torrent salamander, pygmy whitefish, mountain sucker, Salish sucker, leopard dace, and bull trout.
- Reduction of snags in clearcuts, ecotones and oak savannah affects western bluebird.
- Removal of overstory from talus and loss of large woody debris may destroy Larch Mountain salamander and Van Dyke's salamander habitat; overstory removal and roading may isolate populations.

- Logging, conversion to conifers, and firewood cutting in oak habitats may negatively impact Propertius' duskywing, slender-billed white-breasted nuthatch and other oak-dependent species.
- Spraying of BTK can impact butterflies such as Johnson's hairstreak; if meadows receive overspray, mardon skipper, Puget Sound fritillary, and valley silverspot are impacted.
- Modern agricultural practices often reduce the quality, patch size and connectivity of wildlife habitat in farmlands.

Alien and invasive plant and animal species:

- Reed canary grass thrives in reservoirs and wetland stream outlets where water levels fluctuate and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other animals are not well adapted to spawn or reproduce in reed canary grass thickets.
- Alien grasses and weeds affect habitat of mardon skipper, Taylor's checkerspot, Puget Sound fritillary, and valley silverspot.
- Non-native trout such as brook trout compete with, and may hybridize with, bull trout.
- Western gray squirrel are negatively affected by competition from non-native eastern gray and fox squirrel.
- Predation by bullfrogs and/or introduced predatory fish negatively impact western pond turtle; predation by non-native predator fish have eliminated some populations of pygmy whitefish.
- Non-native turtles threaten western pond turtle through competition and the potential for introduced disease.
- Filbert worms and other alien pests affect acorns needed by western gray squirrel and other wildlife species.
- Barred owl have expanded their range and are replacing northern spotted owl in many locations.
- Nutria have expanded their range into the West Cascades ecoregion and can cause extensive wetland vegetation damage.

Human disturbance and recreational impacts:

- Human disturbance can be a significant problem for certain nest sites of peregrine falcon, bald eagle, and golden eagle, and at breeding or maternity roosts and hibernacula of Townsend's big-eared bat.
- Backcountry skiers, heli-skiers, snowmobiles and other motorized vehicles can disturb or displace wolverine.
- Recreational activities such as offroad recreational vehicles, horses, mountain bikes, and even hikers can create unauthorized trails that disturb soil and allow invasive plants to establish and can adversely impact mardon skipper, Taylor's checkerspot, Puget Sound fritillary and valley silverspot habitat.
- The nature and timing of agricultural practices are increasingly hazardous to wildlife. Tilling, planting and harvesting are becoming more synchronous, widespread and intense, thus stressing wildlife during critical periods of nesting, rearing and dispersal.
- Recreational boating can create disturbance problems for common loon and foraging bald eagle; eagles often avoid foraging in water around stationary boats.



Environmental contaminants:

- Concentration of DDE, PCBs, and dioxins from prey causes reduced reproduction of bald eagle on Columbia River. Eagles and peregrine falcon concentrate persistent chemicals such as DDE and PCBs that can cause eggshell thinning, making them vulnerable to any persistent toxic chemical.
- Loons are poisoned by lead fishing sinkers.
- Piscicides used to eradicate unwanted fish have eliminated some populations of pygmy whitefish.

Incompatible transportation and energy development:

- Roads may isolate populations of Van Dyke's and Larch Mountain salamanders.
- Destruction of talus for road building affects Larch Mountain salamanders and rare snails.
- Dams and other passage barriers negatively affect bull trout, green sturgeon, river lamprey and Pacific lamprey, and water level manipulations from hydroelectric dams can affect common loon.
- Eagles and other raptors are susceptible to electrocution on powerlines.
- Western pond turtle and western toad are susceptible to roadkill mortality.
- Highway corridors and development (including Highways 20, 2, 12, and I-90) fragment suitable habitat and create barriers or impediments to movement for wolverine, grizzly bear, gray wolf and other mammals.

Inadequate water quantity and quality:

- Logging, road construction, improperly managed grazing, and development may contribute to sedimentation, increases in water temperature, and pollution runoff, and may affect bull trout, pygmy whitefish, green sturgeon, leopard dace, mountain sucker, Salish sucker, Pacific clubtail, winged floater, Oregon floater, western ridged mussel, and western pearlshell.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protect known populations, augmentation and/or reintroduction of populations, control and monitor mortality and enhance food/prey.

- Implement recovery actions for the grizzly bear, western gray squirrel, fisher, northern spotted owl, marbled murrelet, and western pond turtle and bull trout.
- Develop or finalize recovery plans for the gray wolf, northern spotted owl, bull trout, and mardon skipper.
- Develop management plans for the state sensitive species: common loon, peregrine falcon, Larch Mountain salamander, and pygmy whitefish.
- Continue head starting, captive breeding, and reintroductions of western pond turtle.
- Assess the feasibility of augmenting populations of western gray squirrel, Taylor's checkerspot and mardon skipper and conduct translocations as needed.
- Participate in the North Cascades Grizzly Bear Subcommittee to implement recovery actions.
- Prepare interagency management response guidelines for gray wolf to document sightings and address conflicts.
- After evaluating the success of reintroduction of fishers to Olympic Mountains, reintroduce fishers into the southern Cascades.
- Evaluate other species for possible addition to the state candidate list.
- Implement and enforce restricted harvest regulations for green sturgeon and bull trout.
- Implement eulachon management plan to control harvest. Develop a method to determine the abundance of each year's run size so that harvest may be appropriately scaled to the anticipated run size.
- Complete the Washington Bat Conservation Plan.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat and population trends.

- Monitor population trends of western gray squirrel, grizzly bear, western pond turtle, northern spotted owl, mardon skipper, and bull trout to determine whether recovery objectives are being met.
- Determine the status of candidate species including Townsend's big-eared bat, wolverine, Vaux's swift, pileated woodpecker, northern goshawk, golden eagle, slender-billed white-breasted nuthatch, yellow-billed cuckoo, California mountain kingsnake, western toad, Van Dyke's salamander, Cascade torrent salamander, eulachon, mountain sucker, leopard dace, river lamprey, chinquapin hairstreak, Taylor's checkerspot, Johnson's hairstreak, and valley silverspot.
- Monitor any colonizing wolves to determine establishment of packs and habitat use.
- Conduct periodic surveys of sensitive species including Larch Mountain salamander, common loon, and pygmy whitefish.
- Monitor post-downlisted populations of peregrine and bald eagle for signs of decline that could result from bioaccumulation of contaminants or other factors.
- Investigate limiting factors, the impacts of land management, demographics, and dispersal of western pond turtle, Taylor's checkerspot and mardon skipper.
- Determine the current distribution and abundance of Salish sucker, green sturgeon, Pacific lamprey, winged floater, Oregon floater, western ridged mussel, and western

pearlshell, Puget Sound fritillary, Propertius' duskywing, Pacific clubtail, blue-gray tailedropper and Oregon megomphix. Research effective sampling techniques.

- Identify potential reintroduction sites for western pond turtle.
- Determine appropriate levels of grazing for mardon skipper sites.
- Document and follow up on potential occurrences of western gray squirrel in the ecoregion.
- Conduct studies to identify factors that are responsible for the recent declines in eulachon and western toad.
- Investigate the relationship between oceanic regimes and other ocean occurrences and eulachon run strength.
- Research habitat needs and limiting factors, predation and trophic relationships of river lamprey and Pacific lamprey.
- Develop efficient survey methods for river lamprey and Pacific lamprey; develop methods to differentiate between species of lamprey; identify potential obstacles to lamprey, green sturgeon, and bull trout and develop methods to pass barrier.
- Evaluate effect of timber harvest at landscape scale on occupancy of habitat by northern spotted owl and barred owl.



- Investigate the systematics of western toad, **Salish sucker**, winged floater, Oregon floater, western ridged mussel, and western pearlshell using DNA or other techniques.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update ecoregional assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.
- Develop a cohesive, priority-driven research program for westside grassland habitats that integrates university, agency and private researchers. Inventory of important

grassy and herbaceous balds. Work with land management agencies and private land owners to protect these habitats from disturbance and development.

Protect, restore and connect habitats:

- Identify and protect essential habitat through management agreements, easements, or acquisitions as needed to recover listed species including western pond turtle and mardon skipper.
- Protect oak habitats for western gray squirrel, slender-billed white-breasted nuthatch, Propertius' duskywing, and other oak-dependent wildlife species.
- Protect grassland habitats of Puget Sound fritillary, mardon skipper, Taylor's checkerspot and valley silverspot from residential and recreational development through management plans, conservation agreements, easements, or acquisition.
- Protect sites where blue-gray tailed dropper, Oregon meadowlark occur.
- Protect hydrology of known sites and restore wet meadows and wetlands for western pond turtle and other wetland species through incentives, management programs, or acquisitions; conserve beaver populations and dynamic stream processes.
- Reduce mortalities of eagles and other raptors through modification of electric transmission and distribution lines.
- Continue to require bald eagle habitat plans that include retention of trees. Enforce and strengthen Shoreline Management Act.
- Identify and protect preferred roost and hibernacula sites for Townsend's big-eared bat and limit access to these areas.
- Protect rare habitat types such as grassy and herbaceous balds, aspen stands, snag patches, caves, cliffs, and talus.
- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas, and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented, or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.

- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers and estuaries.

Improve land management practices:

General

- Buffer meadows and native grasslands from BTK spraying to protect Taylor's checkerspot, Puget Sound fritillary, mardon skipper, and valley silverspot.
- Conduct prescribed burns on grassland sites where and when needed and feasible for Puget Sound fritillary, mardon skipper, valley silverspot, and other rare butterflies.
- Maintain and enforce Forest Practice rules protecting northern spotted owl nests, and bald eagle roosts and nests.
- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Forest management

- Protect remaining old growth conifer and hardwood stands to benefit late successional species, and manage some stands on long rotations (>200 years) for northern spotted owl, marbled murrelet, Vaux's swift, northern goshawk, pileated woodpecker, Van Dyke's salamander and Johnson's hairstreak.
- Maintain stream buffers during timber harvest and conduct proper land use management to protect Cascade torrent salamander, bull trout, mountain sucker, Salish sucker, leopard dace, pygmy whitefish and bivalves.
- Do not remove overstory from talus in range of Larch Mountain salamander.
- Evaluate effectiveness of current management practices for maintaining forest species including northern spotted owl, marbled murrelet, pileated woodpecker and Vaux's swift.
- Protect and maintain chinquapin stands in the Gifford Pinchot National Forest for the chinquapin hairstreak.
- Survey mature bigleaf maple stands before timber harvest for **blue-gray tailedropper** and Oregon megomphix and protect moist conditions at all occurrences.
- Work with the Washington Department of Natural Resources and the Washington Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the Washington Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem function. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions. Retain snags, downed woody debris and a complement of live trees in harvested areas. Sensitive areas such as wetlands, remnant old growth and wildlife breeding sites should not be disturbed.



- Encourage the development of selective harvest policies and guidelines on both public and private forestland that will leave adequate components of old growth habitat such as snags and downed wood as habitat for associated wildlife such as pileated woodpecker, Vaux's swift, and western bluebird.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Support implementation and enforcement of the Washington Forest Practices Act to accomplish habitat conservation and regeneration on both state and private forestlands.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.
- In dry site forests, implement silvicultural practices that improve stand age-class and structural diversity, retain large, dominant oaks, ponderosa pine and Douglas-firs and standing dead and dying trees, create snags instead of removing trees, and leave fallen trees, limbs and leaf litter for foraging, nesting and denning sites. Use prescribed burns to maintain open savannah in appropriate areas.

Grazing and agricultural practices

- Work with public and tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use, grazing and soil erosion.
- Prevent grazing that degrades habitat for mardon skipper, Taylor's checkerspot, Puget Sound fritillary, and valley silverspot.

Control and prevent introduction of alien and invasive species:

- Control bullfrogs and predatory fish as needed for western pond turtle and amphibians of conservation concern.
- Remove nutria from wetlands to prevent destruction of wetland vegetation.
- Control weeds and alien grasses on native grasslands for mardon skipper, Taylor's checkerspot, Puget Sound fritillary, and valley silverspot.

- Enforce restriction on transplantation of fish, non-native turtles, bullfrogs, and other alien species to protect western pond turtle, bull trout, pygmy whitefish, Salish sucker, mountain sucker, leopard dace, and Pacific clubtail.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout and native amphibians and reptiles. Avoid introduction of non-native trout to protect bull trout from hybridization, competition, and predation.
- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and coordination of weed control efforts on both public and private lands using environmentally-sound methods.
- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.

Control and monitor disturbance:

- Protect Townsend's big-eared bat and nesting peregrine falcon, golden eagle and bald eagle through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting; inform rock climbers of sensitive periods and locations to reduce disturbance of nesting *peregrine falcon*.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats such as montane wetlands, bogs, prairies, and dunes.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.



Control and prevent environmental contamination:

- Facilitate use of nontoxic alternatives to fishing sinkers to protect common loon.
- Work with other agencies to reduce and remediate sources of contaminants that contribute to prey contamination for bald eagle, peregrine falcon, etc.
- Do not use pesticides to eradicate unwanted fishes in lakes with pygmy whitefish, and where other species of conservation concern may be present.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments whenever possible, and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Continue to place a priority on actions to prevent and respond to oil and hazardous material spills.

Improve transportation and energy development:

- Reduce mortalities of eagles and other raptors through modification of electric transmission and distribution lines
- Avoid roadbuilding near breeding sites, or provide crossings for western pond turtle, western toad, Van Dyke's salamander and Larch Mountain salamander.
- Discourage use of talus for roads to prevent destruction of Larch Mountain salamander and California mountain kingsnake habitat.
- Where feasible, remove barriers to passage for bull trout, green sturgeon, river lamprey and Pacific lamprey.
- Work with the Washington Department of Transportation to locate highways away from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife that need passage, including gray wolf, wolverine, grizzly bear and other large mammals, and western toad and salamanders.

Improve water quantity and quality:

- Work with public and private landowners through education, planning and regulatory pathways to reduce sedimentation and pollution for bull trout, green sturgeon, Salish sucker, mountain sucker, leopard dace, pygmy whitefish, Cascade torrent salamander, winged floater, Oregon floater, western ridged mussel, and western pearlshell.
- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as conserving beaver

populations and dynamic stream processes to benefit species like bull trout, Salish sucker, mountain sucker, western ridged mussel, and western pearlshell.

- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts, or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.

Improve coordination, planning, permitting and mitigation:

- Continue to require bald eagle habitat plans that require retention of trees. Enforce and strengthen Shoreline Management Act
- Protect nesting golden eagle, northern spotted owl and peregrine falcon by maintaining buffer zones of no activity during nesting.
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation, as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, Shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.

- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Represent WDFW's conservation interests on interagency recovery teams and working groups.

Improve enforcement of laws and regulations:

- Protect listed wildlife through enforcement, education and outreach.
- Enforce prohibition of killing bald eagle and non-permitted possession of parts through investigation and vigorous prosecution.
- Limit access to roadless, wilderness and primitive areas; prevent disturbance of denning areas for wolverine.
- Reduce illegal capture for pet trade of ***California mountain kingsnake***.
- Enforce restriction on transplantation of fish to protect western pond turtle, bull trout, pygmy whitefish, Salish sucker, mountain sucker, leopard dace, Pacific clubtail and native amphibians.
- Enforce recreational access restrictions on public lands and aquatic areas.



Improve landowner assistance:

- Develop, periodically update, and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.
- Work with large and small timber companies and landowners to accomplish habitat conservation through non-regulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity and protect these areas through landowner incentives and other nonregulatory programs. Important habitats include balds, oak woodlands, and old growth.
- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife, and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.

- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.

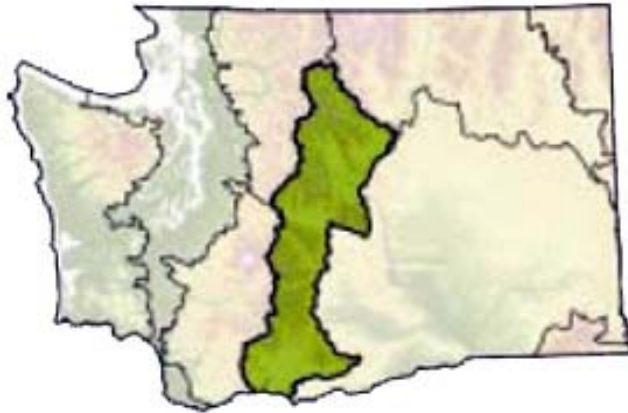
Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Facilitate use of nontoxic alternatives to fishing sinkers to protect common loon.
- Develop or disseminate education materials to prevent introductions of alien shellfish competitors of winged floater and Oregon floater.
- Develop education program targeted to reduce disturbance of common loon and bald eagle by boaters.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.
- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.



Fisher.

EAST CASCADES ECOREGION



PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The East Cascades ecoregion in Washington lies east of the Cascade crest, from Sawtooth Ridge near Lake Chelan south to the Columbia Gorge. Its eastern border follows the montane forest – lowland shrub-steppe transition. Approximately 10 percent of Washington is included within this ecoregion. According to the Washington Gap Project, as of 1991, less than 2 percent of the Washington portion had been converted to agricultural or urban development. The development that has occurred is concentrated in the Chelan, Wenatchee, upper Yakima, and Little White Salmon valleys.

Geology

The East Cascades of Washington were shaped by alpine glaciers and landslides that created rugged ridges extending southeast to east from the Cascade crest. Broad valleys occupy the lowlands between the mountain ridges. Isolated volcanic cones appear on the steep mountain ridges, but with the exception of Mt. Adams are not as high as volcanoes in the Western Cascades. The East Cascades have a varied geology, including large serpentine areas in the Wenatchee Mountains. The typical elevation range is between 2,000 and 7,000 feet. Mt. Adams is the highest peak at 12,276 feet. The lowest elevation is in the Columbia River Gorge at 100 feet. The Wenatchee and Simcoe mountains are eastward extensions of this ecoregion.

Climate

The climate changes rapidly west to east, from cold with high precipitation (120 inches) along the Cascade crest to hot and dry with less than 20 inches per year along the foothills. Most precipitation accumulates from November through April. A snow pack develops at higher elevations.

Habitat and Plant Associations

Forests of grand fir, Douglas-fir and ponderosa pine dominate the East Cascades ecoregion. Oregon white oak woodlands appear at lower elevations in the southern half of the ecoregion, and subalpine fir, mountain hemlock and Engelmann spruce are found at higher elevations. Whitebark pine, lodgepole pine, and western larch are common components of these forests. Historically, fires occurred at irregular intervals from 10 years in the lowland foothills to 150 years or more at high elevations. Forest stand patterns on the landscape often reflect this complex fire history. In some areas, decades of fire suppression have resulted in large areas of dense, fire-prone forests. Shrub-steppe vegetation composed of big sagebrush or antelope bitterbrush and native bunchgrasses occurs along the foothills and higher south-facing slopes.

Fish and Wildlife Diversity

Large mammals include elk, blacktail and mule deer, cougar and black bear. Mountain goats inhabit high elevations in the central and northern part of the ecoregion, but are largely absent from the southern portion of their range. Fisher, once common in this ecoregion, are now rare or extirpated. Blue and ruffed grouse, owls, hawks, and songbirds are common. Woodpeckers and other cavity nesters are common. The wetlands are home to many waterfowl such as Canada geese, ducks, herons, and various song birds. Bald and golden eagles inhabit a small portion of their historic ranges and are very limited in distribution. The peregrine falcon is making a comeback in the ecoregion. Anadromous fish such as coho and chinook salmon and steelhead inhabit the streams and rivers, their distribution and numbers are significantly reduced. Rainbow and cutthroat trout are the common cold water inhabitants. Bull trout are found, but their occurrence is significantly restricted from historic ranges. Kokanee are particularly associated with lakes in the northern and central portions of this ecoregion.



LAND OWNERSHIP

The single largest landowner in the East Cascades ecoregion is the U.S. government. Most of the federal land is within the Wenatchee National Forest. Major landowners in the East Cascades ecoregion are the U.S. Forest Service, the Yakama Nation, Washington Department of Natural Resources, Washington Department of Fish and Wildlife, and private timber companies. The Washington Department of Fish and Wildlife manages about 113,267 acres in the ecoregion, including the Colockum, Oak Creek, L.T. Murray, Wenas, and Chelan Butte Wildlife Areas. Dominant land uses are forestry, livestock grazing, recreation and conservation. Timber companies have recently begun to sell lands for development in the non-federal, mid-elevation forest and transition zone.

Although less than 25% of the ecoregion is privately owned, nearly two-thirds of the anadromous streams, primarily lower gradient streams, are bordered by private lands along the mainstems of the Wenatchee, Naches and Yakima Rivers. Figure 25 below maps land ownership classes in the East Cascades ecoregion.

East Cascades Ecoregion **Land Ownership Classes**

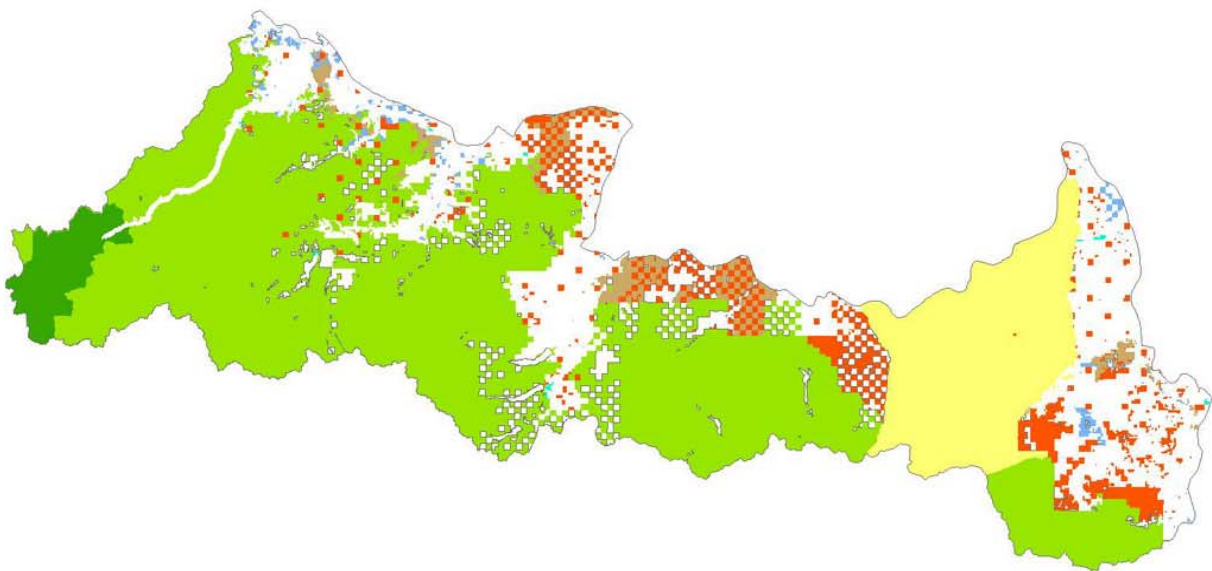
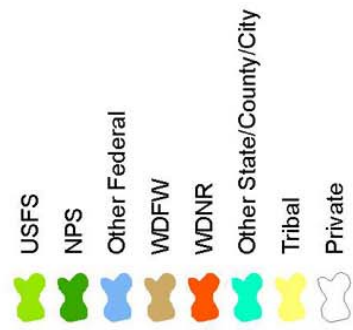
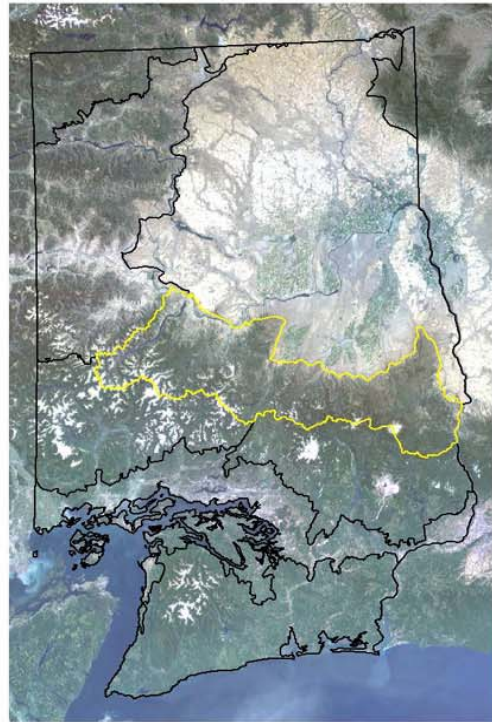


Figure 25.



ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the East Cascades ecoregion include:

- U.S. Bureau of Reclamation
- U.S. Bureau of Land Management
- U.S. Fish and Wildlife Service (Pierce and Conboy Lake National Wildlife Refuges)
- USDA Forest Service (Wenatchee National Forest)
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission
- Yakama Indian Nation

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Trust for Public Land, Rocky Mountain Elk Foundation, Audubon Washington, Ducks Unlimited and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the East Cascades ecoregion. Important planning efforts affecting conservation in the East Cascades ecoregion include:

- East Cascades Ecoregional Assessment
- Interior Columbia Basin Ecosystem Management Project
- Intermountain West Joint Venture Coordinated Bird Conservation Plan (2005)
- Northwest Forest Plan (1994)
- USFWS Draft Bull Trout Columbia River DPS Recovery Plan (2004)
- USFWS Draft Northern Spotted Owl Recovery Plan (1992)
- USFWS Grizzly Bear Recovery Plan (1993)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Draft East Cascades Regional Wildlife Area Management Plan
- WDFW Fisher Recovery Plan (2005)
- WDFW Game Management Plan (2003)
- WDFW Larch Mountain Salamander Status Report (1993)
- WDFW Lynx Recovery Plan (2001)
- WDFW Mardon Skipper Status Report (1999)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Western Gray Squirrel Recovery Plan (2005)
- WDFW Western Pond Turtle Recovery Plan (1999)
- Yakima, Lake Chelan, Wenatchee and Klickitat Subbasin Plans

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the East Cascades ecoregion.

Species of Greatest Conservation Need

The following species list for the East Cascades ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two, Approach and Methods, as well as in Appendix 3. Species listed below are found in the East Cascades ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Mammals												
Townsend's big-eared bat			x							x	C	S3
Western gray squirrel			x				x				T	S2
Gray wolf	?									x	E	S1
Grizzly bear		x							x		E	S1
Fisher	x							x			E	SH
Wolverine		x						x			C	S1
Lynx			x							x	T	S1
Birds												
Common loon			x					x			S	S2
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Mountain quail			x							x	G	S1
Sandhill crane (greater)		x							x		E	S1
Flammulated owl			x							x	C	S3
Northern spotted owl			x				x				E	S1
Vaux's swift			x				x				C	S3
Lewis' woodpecker			x				x				C	S3
Acorn woodpecker		x						x			M	S1
White-headed woodpecker			x				x				C	S2
Black-backed woodpecker			x							x	C	S3

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Pileated woodpecker				x						x	C	S4
Pygmy nuthatch			x							x	N	S3
Reptiles												
Western pond turtle			x						x		E	S1
Sharptail snake			x							x	C	S2
California mountain kingsnake			x							x	C	S1
Amphibians												
Larch Mountain salamander			x							x	S	S3
Western toad				x			x				C	S3
Oregon spotted frog			x				x				E	S1
Columbia spotted frog			x							x	C	S4
Fish												
River lamprey						x				x	C	S2
Pacific lamprey						x				x	N	S3
Westslope cutthroat				x				x			G	G4
Bull trout						x				x	C	G3
Mid-Columbia steelhead											C	G5
Yakima steelhead											G	G5
Mid-Columbia coho											G	G4
Pygmy whitefish						x				x	S	S1
Leopard dace						x				x	C	S2
Mountain sucker						x				x	C	S2
Invertebrates												
Propertius' duskywing (butterfly)			x				x				M	S3
Mardon skipper (butterfly)		x								x	E	S1
Chinquapin hairstreak (butterfly)			x							x	C	S1
Juniper hairstreak (butterfly)						x				x	C	S2

* Status Codes

E = endangered
T = threatened
S = sensitive
C = candidate
M = monitor

** WNHP Codes (S = state, G = global)

1 = critically imperiled
2 = imperiled
3 = vulnerable to extirpation or extinction
4 = apparently secure
5 = demonstrably widespread, abundant and secure

Species Conservation in the East Cascades Ecoregion

Species of Greatest Conservation Need (SGCN) found in the East Cascades ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Sensitive, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. Conservation actions are recommended for these SGCN species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

Ecoregional Habitat Overview

Most natural habitats in the East Cascades ecoregion are relatively intact and dominated by natural or semi-natural vegetation. Over a century of timber harvest however, has degraded dry forests through consistent removal of large-diameter overstory trees, particularly ponderosa pine. This ecoregion contains two of Washington's highest concentrations of rare plants, located in the Columbia River Gorge and the Wenatchee Mountains. The southern portion of the ecoregion contains fescue grasslands, which harbor the Mardon skipper, a Washington state endangered species and federal candidate butterfly.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the East Cascades ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Montane Mixed Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine and Eastside White Oak Forest and Woodlands
- Upland Aspen Forest
- Subalpine Parkland
- Alpine Grasslands and Shrublands
- Eastside (Interior) Grasslands
- Shrub-steppe
- Dwarf Shrub-steppe
- Agriculture, Pasture and Mixed Environs
- Urban and Mixed Environs
- Open Water: Lakes, Rivers and Streams
- Herbaceous Wetlands
- Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands

East Cascades Ecoregion

Wildlife Habitat Classes

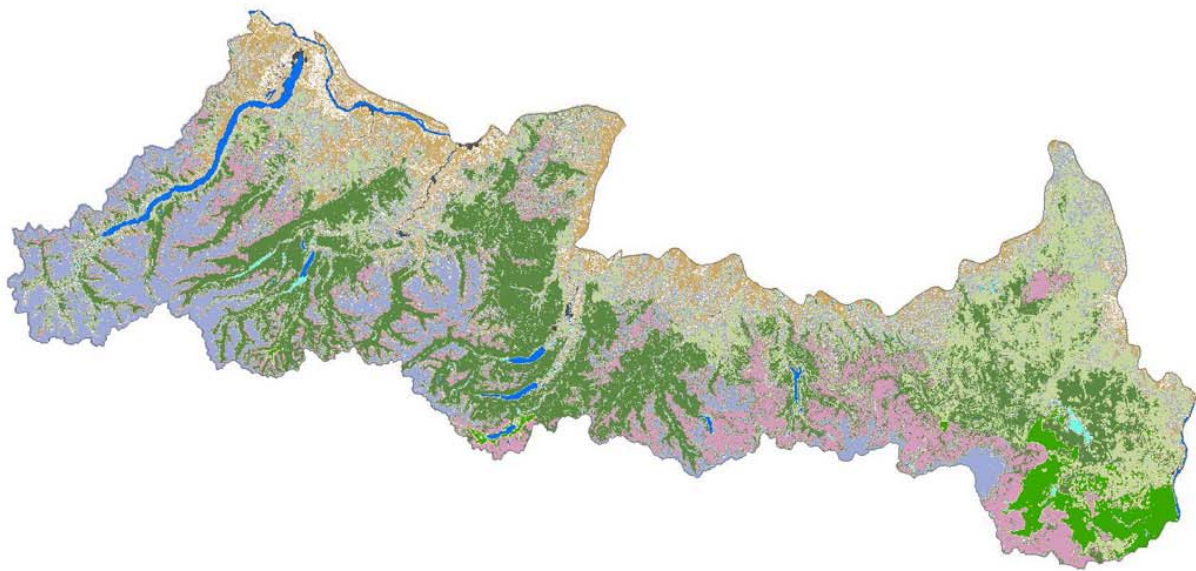
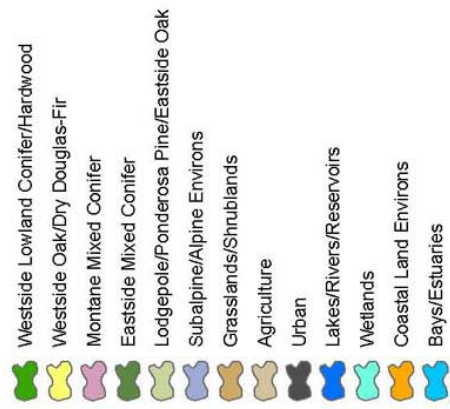


Figure 26.

Priority Habitats in the East Cascades Ecoregion

The following five habitat types have been identified as the highest priority for current conservation action in the East Cascades ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the East Cascades Ecoregional Assessment and the subbasin plans listed in the “Major Plans” section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two: Approach and Methods.

- Ponderosa Pine and Eastside White Oak Forest and Woodlands
- Montane and Interior Mixed-Conifer Old Growth Forest
- Shrub-steppe
- Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands

Ponderosa Pine and Eastside White Oak Forest and Woodlands

Ponderosa pine/Oregon white oak woodland habitats are unique dry forest ecosystems in the East Cascades ecoregion, due to the rain shadow and topography of the east slope of the Cascades. Oregon white oak woodlands exist to a lesser extent than ponderosa pine in the East Cascades ecoregion, and are an important and unique habitat. Together they occupy about 16% of the ecoregion.

Ponderosa pine forms climax stands that border native grasslands and is a common member in many other forested communities. It is a drought tolerant tree that usually occupies the transition zone between grassland and forest. Climax stands are characteristically warm and dry, and occupy lower elevations throughout their range. Key understory associates in climax stands typically include grasses such as bluebunch wheatgrass and Idaho fescue, and shrubs such as bitterbrush and common snowberry.

Ponderosa pine has many fire resistant characteristics. Seedlings and saplings are often able to withstand low-intensity fires. Pole-sized and larger trees are protected from the high temperatures of fire by thick, insulating bark, and stems are protected by the surrounding needles and bud scales.

Other aspects of the pine’s growth patterns help in temperature resistance. Lower branches fall off the trunk of the tree, and fire caused by the fuels in the understory will usually not reach the upper branches. Ponderosa pine is more vulnerable to fire at more mesic sites where other conifers as Douglas-fir and Grand fir form dense understories that can carry fire upward to the overstory. Ponderosa pine seedlings germinate more rapidly when a fire has cleared the grass and the forest floor of litter, leaving only mineral rich soil.

Ponderosa pine is also shade intolerant and grows most rapidly in near full sunlight. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that gives the habitat a more closed, multi-layered canopy. For example, this habitat includes previously natural fire-maintained stands in which grand fir can eventually become the dominant canopy species. Large late-seral ponderosa pine and Douglas-fir are harvested for timber in much of this habitat. Oregon white oak is frequently cut for fuel wood, or removed during thinning as competition with desired timber species. Under most management regimes, typical tree size decreases and tree density increases in this habitat. Ponderosa pine-Oregon white oak habitats are now denser than in the past and may contain more shrubs than in pre-settlement habitats.

**Selected Species Closely Associated with
Ponderosa Pine Forest and Woodlands
in the East Cascades Ecoregion**

Flammulated owl	Northern goshawk
Pygmy nuthatch	Western gray squirrel
White-headed woodpecker	

Montane and Interior Mixed-Conifer Old Growth Forest

This habitat makes up most of the continuous montane forests of the inland Pacific Northwest. It contains a wide array of tree species and stand dominance patterns. Douglas-fir is the most common tree species. It is almost always present and dominates or co-dominates most overstories. Low elevations or drier sites may have ponderosa pine co-occurring with Douglas-fir in the overstory and often have other shade-tolerant tree species growing in the undergrowth. On moist sites, grand fir, western redcedar and western hemlock occur. Other conifers include western larch and western white pine.

In the Eastern Cascades ecoregion, the remaining patches of old-growth forests of ponderosa pine, western larch, and Douglas-fir are home to a variety of wildlife including goshawk, martens, and northern spotted owls. Old growth forests of ponderosa pine, western larch, and Douglas-fir in this ecoregion are threatened by logging. Old growth Ponderosa forests are now very rare.

Prior to European settlement (pre-1850), a wide variety of disturbances characterized this habitat, ranging from frequent small-scale and localized events such as treefall gaps to rare, large-scale events such as stand-replacing fires and epizootic outbreaks. Such disturbances resulted in a dynamic equilibrium between patch creation and loss. This active disturbance regime has resulted in a larger proportion of younger seral stages than in areas west of the Cascade Mountains. However, the low-elevation (2900-4900 ft) forests, which experienced frequent low-intensity fires, were predominantly (up to 90%) old growth ponderosa pine. In general, forest ecosystems in this region are adapted to more frequent fire disturbances than mesic westside forests. Fire cycles range from periodic (5-15 years) surface fires in dry and warm ponderosa pine and Douglas-fir types, to infrequent (more than 100 yrs and up to 900+ yrs) stand-replacement crown fires in mesic and cool western redcedar, western hemlock, and cedar/spruce forest types. Such disturbances played a crucial role in maintaining inland forest structure, species composition, and ecosystem processes. However, fire suppression has shifted disturbance regimes and landscape dynamics to less frequent and more intense fires, and frequent and large-scale anthropogenic disturbances such as logging have disrupted natural processes and led to declines in various ecosystem types and species.

**Selected Species Closely Associated with
Montane and Interior Mixed-Conifer Forest
in the East Cascades Ecoregion**

Fisher	Flammulated owl
Northern goshawk	Northern spotted owl
Pileated woodpecker	Black-backed woodpecker
Vaux's swift	

Shrub-steppe

Historically, shrub-steppe vegetation associations were commonly interspersed with one another forming a diverse mosaic at lower elevations of the East Cascades ecoregion. The combination of elevation, aspect, soil type, and proximity to surface and/or ground water contributed to the vegetation potential of any given site. Fire was likely the primary disturbance factor for native shrub-steppe communities, with intervals ranging between 50 and 200 years, depending on precipitation and elevation gradients. Large mammals such as elk, small mammals such as ground squirrels, and flooding in perennial and ephemeral streams probably contributed secondary localized disturbance roles. Shrubs and perennial bunchgrasses co-dominated the lower-elevation landscape, with a microbiotic crust of lichens, mosses, green algae, and microfungi on the surface of the soil. Because they bind soil particles together, biotic crusts are critical for protecting the soil from wind and water erosion, fixing nitrogen, accumulating nutrients used by vascular plants, and reducing encroachment by invasive species. The dominant native shrub-grass associations in the East Cascades of Washington are antelope bitterbrush, three-tip sagebrush, bluebunch wheatgrass and Idaho fescue.

Scattered throughout this dominant cover type were many other bunchgrasses including Sandberg's bluegrass, needle and thread, Thurber's needle grass, Idaho fescue, Indian rice grass, squirreltail, and Cusick's bluegrass. Scattered shrubs also included two rabbitbrush species and short-spine horsebrush, antelope bitterbrush, spiny hopsage, rigid sagebrush, basin sagebrush and three-tip sagebrush. Most of these shrub species had their own unique association with one or more bunchgrasses and dominated a portion of the landscape. For example, at higher elevations and north facing slopes three-tip sagebrush and Idaho fescue was the dominant association. On ridge tops where shallow soils were common, rigid sagebrush and Sandberg's bluegrass and/or bluebunch wheatgrass dominated. Rabbitbrush was common in areas where fires had recently burned. Within the shrub steppe landscape there also were alkaline adapted community types, usually associated with drainage bottoms, perennial and ephemeral streams, or seeps and springs. This vegetation association, more common to the Great Basin than the Cascades, included black greasewood, basin wildrye, and inland saltgrass.

It has been estimated that only 40 percent remains of the roughly 10.4 million acres of shrub-steppe that once existed in Washington prior to the 1850s, substantially reducing the amount of habitat available for shrub-steppe-associated wildlife. The greater sage grouse, for example, requires large landscapes for cover and forage. Bunchgrasses conceal nests and provide cover for broods. Pre-nesting hens and young chicks consume forbs and associated insects. The Brewer's sparrow needs dense sagebrush for nesting and post-fledging success. Although they do not require large landscapes typically associated with sage grouse, breeding success has been shown to decrease as patch size decreases. Mule deer migrate to shrub-steppe habitat in fall and winter, depending on a variety of native shrubs, forbs, and grasses.

The loss of once extensive shrub-steppe communities has reduced substantially the habitat available to a wide range of shrub-steppe associated wildlife, including several birds found only in this community type. More than 100 bird species forage and nest in sagebrush communities, and at least four of them--the greater sage-grouse, sage thrasher, sage sparrow and Brewer's sparrow--are obligates.

**Selected Species Closely Associated with
with Shrub-steppe
in the East Cascades Ecoregion**

Townsend's big-eared bat	American badger
Townsend's ground squirrel	Mardon skipper butterfly

Eastside (Interior) Riparian-Wetlands

In the East Cascades ecoregion, riparian forest habitats are critical to the structure and function of rivers and to the fish and wildlife populations dependent on them. The density and diversity of wildlife in these riparian areas is high relative to other habitat types. Riparian habitats are strongly influenced by associated stream dynamics and hydrology; to remain viable, they require appropriate flooding regimes and specific substrate conditions for native riparian vegetation. Historically, annual flood cycles and associated groundwater dynamics created thermal conditions that were conducive to riparian habitat and wildlife use throughout the season. Fire also influenced riparian habitat structure in most areas, but was nearly absent in colder regions or on topographically protected streams. River meander patterns, ice and log jams, sediment dynamics and flood debris deposits also provided spatial and temporal changes in habitat condition. Abundant beaver activity in riparian zones cropped younger cottonwoods and willows, dammed side channels, and created diverse and complex habitat interactions.

Healthy forested riparian wetland habitat has an abundance of snags and downed logs that are critical to many cavity nesting birds, mammals, reptiles and amphibians. Cottonwood, alder and willow are commonly dominant tree species in riparian wetland areas from the Cascades down through the valley portion of the ecoregion. This habitat is often characterized by relatively dense understory and overstory vegetation. Riparian wetland habitats also function as travel corridors between, and provide connectivity to breeding, feeding and seasonal ranges.

Although riparian-wetland habitats are usually forested, they also contain important habitat components such as marshes and ponds that provide critical habitat for a number of wildlife species. Broad floodplain mosaics consisting of cottonwood gallery forests, shrub lands, marshes, side channels, and upland grass areas contain diverse wildlife assemblages. The importance of riparian wetland habitats is increased when adjacent habitats are of sufficient quality and quantity to provide cover for nesting, roosting, and foraging.

Riparian conditions in the East Cascades ecoregion are varied, ranging from severely degraded to nearly pristine. Good riparian habitat generally is found along forested, headwater reaches, whereas degraded stream channels and riparian habitat is concentrated in the valleys, where it is frequently associated with residential development, grazing and agricultural activity. Recreational development is also having an increasing impact, especially along the upper Yakima River in the critical reach from the city of Cle Elum to Easton Dam.

**Selected Species Closely Associated with
Eastside (Interior) Riparian Wetlands
in the East Cascades Ecoregion**

Columbia spotted frog
Western toad

Great blue heron

Montane Coniferous Wetlands

In the forest zone of the East Cascades ecoregion, montane coniferous wetlands provide important ecological and hydrologic function disproportionate to their size on the landscape. They are positioned at the headwaters of many important river tributaries and aid in the collection and slow delivery of snowmelt to the region's rivers and streams. These wetlands also provide critical habitat for many specialized plant and animal species.

This habitat is typified as forested wetlands or floodplains with a persistent winter snow pack, and the topography includes everything from steep mountain slopes to nearly flat valley bottoms. Subsurface water flow within the rooting zone of these wetlands is common on slopes with impermeable soil layers, and flooding regimes range from saturated to seasonally and temporarily flooded. Seeps and springs are common.

These wetlands occur along stream courses or as small patches within a matrix of montane mixed conifer forest, or less commonly, eastside mixed conifer forest or lodgepole pine forest and woodlands. They also can occur adjacent to and intermixed with other wetland habitats, particularly riparian wetlands and herbaceous wetlands, and occur within a forest or woodland dominated by evergreen conifer trees. Deciduous broadleaf trees are occasionally co-dominant, and the understory is dominated by shrubs (most often deciduous and relatively tall), forbs or grasses. Areas of herbaceous vegetation may occur in forested wetlands, often with conifers encroaching along the edges of wet meadows and wetlands.

**Selected Species Closely Associated with
Montane Coniferous Wetlands
in the East Cascades Ecoregion**

Wolverine
Columbia spotted frog

Western toad

CONSERVATION PROBLEMS

A number of human activities pose potential threats to the integrity of wildlife habitat. These activities include incompatible forest and grazing practices, conversion of habitat to agriculture, urbanization, dispersed residential development, pollution, overfishing and overhunting, water extraction, incompatible mining, hydropower and energy developments and transportation systems. These developments disturb and displace wildlife, disrupt migration corridors, and encourage the establishment of invasive plant and animal species.

Habitat Loss and Fragmentation

Ponderosa pine habitats are in major decline in the East Cascades ecoregion of Washington State, especially mature pine forests. In fact, it is estimated that 99% of the mature ponderosa pine forest has been lost to a number of factors, including direct habitat loss from rural residential and recreational development; encroachment of mixed conifer forest into mature ponderosa pine forests; and loss of old forest overstory due to logging. Weeds are an issue in some areas where extensive road networks have led to the establishment of knapweed and other aliens. Improperly managed grazing in some portions of the dry forest causes extensive damage to wet areas, including springs and small streams.

Forest practices that include improperly built and managed logging roads, timber harvest, and altered fire regimes are the principal causes of habitat diversity loss in this ecoregion. Historic conditions have been heavily altered by the selective removal of large overstory ponderosa pine and Douglas fir trees and the proliferation of shade-tolerant, mixed forest conifer species, particularly grand fir, within ponderosa pine communities. Fire suppression policies that preclude the natural, low-intensity fire cycles favored by ponderosa pine and Oregon white oak are the most serious cause of this unintentional recruitment of other species. The resultant stands at all seral stages tend to lack snags, have high tree density, and are composed of smaller and more shade-tolerant trees. Late seral forests of ponderosa pine and Douglas-fir are now essentially gone. Early seral forest abundance is similar to that found historically but lacks snags and other old growth features.

The replacement of mixed conifer stands, as well as high-intensity wildfires in these stands, has resulted in an attendant reduction in ponderosa pine habitat-obligate wildlife species. Even though this habitat is more extensive than pre-1900, natural processes and functions have been modified enough to alter its natural status as functional habitat for many wildlife species.

The direct loss and fragmentation of habitat from improperly managed grazing, agricultural development, residential and recreational development and off-road recreational activities is the most significant conservation problem in shrub-steppe habitat in the East Cascades ecoregion. The loss of migration corridors is a particularly severe problem for shrub-steppe dependent wildlife in the East Cascades ecoregion.

Invasive Alien Plant and Animal Species

The invasion of cheatgrass and other alien plant species, brought on primarily by improperly managed grazing, destruction of microbiotic soil crusts and the alteration of natural fire regimes, is the second most important problem in shrub-steppe habitat. Alien species displace native grasses and understory vegetation, resulting in the loss of habitat diversity and function. This is a problem on both public and private lands. Improperly managed grazing has a doubly adverse impact, not only eliminating native grasses but also breaking

down and destroying the soil crust of mosses and lichens that supports native grasses and shrubs.

Hydropower

Dams on major rivers present a daunting challenge to the upstream and downstream migration of anadromous fish. Millions of dollars have been and continue to be spent by public agencies and hydropower users to ensure passage of salmon, sturgeon and lamprey through the dams and to otherwise mitigate for the loss of unimpeded migration corridors and habitat. Unless dams are removed from large rivers, which is highly unlikely, the most pressing problems for migrating fish will continue to be caused by the dams, including inadequate fish ladders on some mainstem dams, predation within the mainstem reservoirs from walleye and other fish, nitrogen loading and mortality to downstream migrating juveniles from turbines.

Hydrological diversions and control of natural flooding regimes results in reduced stream flows and reduction of overall area of riparian habitat, loss of vertical stratification in riparian vegetation, and lack of recruitment of young cottonwoods, ash, willows, etc. Hydro projects also destabilize streambanks, narrow stream channels, reduce the flood zone, and reduce the extent of riparian vegetation. The loss of riparian vegetation has resulted in greater summer heating and winter cooling, soil instability, reductions in water quantity and quality, and changes in bank, channel and instream structure.

Riparian-wetlands have been lost or degraded on a large scale in the East Cascades ecoregion. The most severe long-term problem, on a regional scale, is the direct conversion and fragmentation of riparian habitat to homes, commercial buildings, and other permanent structures. The construction of levees and streambank armoring also results in a permanent loss of habitat in most cases. Once streamside habitat is lost to concrete or lawn, it is usually gone forever, and once a riparian corridor is fragmented by development its utility for wildlife movement is severely compromised or eliminated.

Other problems include improperly managed grazing, channelization, gravel mining, unauthorized roading and off-road recreational use, dumping, and the elimination of beaver from overtrapping and habitat loss. This, coupled with poor habitat quality and fragmentation of existing vegetation, has resulted in extirpation or significant reductions in riparian habitat-obligate wildlife species.

Flooding, debris flow, fire and wind are the major natural disturbances to montane wetlands. Many of these areas are seasonally or temporarily flooded, and heavy floods reshape stream channels and riparian surfaces, which in turn create opportunities for recruitment and redistribution of woody debris. Montane wetland habitats are commonly invaded by undesirable alien plant species due to improperly managed grazing, altered fire frequencies and off-road vehicle use, as well as altered hydrology due to poorly designed roads, culverts and unregulated off-road vehicle use. These factors also encourage the encroachment of trees into herbaceous wetland habitats. The vegetative condition of riparian wetlands and meadows has been degraded, resulting in impaired hydrologic functions, especially those occurring in unregulated tributaries.

Transportation Systems

Transportation systems impact animals in several ways: roadkill, habitat loss and fragmentation, and hindrance or barrier to movement and migration. When populations are low, roadkill mortality is significant, especially for slow moving turtles and salamanders and wide-ranging carnivores that have to cross many roads. In a fragmented landscape, animals have to move from one patch of habitat to another. When highways fragment landscapes, they divide wildlife populations into smaller, isolated units that are more susceptible to extirpation. Historically, construction of logging roads near streams or across wetlands was often extremely destructive to fish and wildlife habitat. Although modern forest practices under state and federal rules are much more likely to provide some protection for wetlands, there are still potential adverse impacts from construction and operation of logging roads. This occurs even when they are located along benches and ridgelines away from riparian zones. Improperly located, constructed or maintained logging roads may trigger or accelerate slope failure, erode stream channels, block fish migration and deposit sediment into streams and wetlands.

The following additional habitat and species conservation problems have been identified in the East Cascades ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest and limited population size/distribution.

- Populations of western gray squirrel, lynx, fisher, grizzly bear, gray wolf, northern spotted owl, greater sandhill crane, western pond turtle, Oregon spotted frog and mardon skipper have declined to the point where they are listed as threatened or endangered.
- Recovery plans are needed to guide conservation actions for threatened or endangered species including gray wolf, mardon skipper and Oregon spotted frog.
- Wolves are expected to re-colonize forested parts of Washington and interagency management response guidelines are needed.
- Management plans are needed for the sensitive species such as common loon, peregrine falcon, Larch Mountain salamander and pygmy whitefish.
- Small population sizes and loss of genetic diversity is a problem in western gray squirrel and may be a concern in wolverine, mountain quail, sharp-tailed snake, California mountain kingsnake, acorn woodpecker, bull trout, pygmy whitefish and several other species. Fisher and gray wolf are virtually extinct in the East Cascades.
- Mange is a major mortality factor for the western gray squirrel.
- Sudden oak death syndrome may become established in Washington and would threaten oak woodlands, and many of its dependent wildlife species.
- Illegal persecution and harvest occurs for bald eagle, California mountain kingsnake and migrating and spawning fish species of concern.

Lack of biological information on species and habitats:

- Data are needed on population trends for state threatened and endangered species including western gray squirrel, lynx, northern spotted owl, greater sandhill crane, western pond turtle, Oregon spotted frog and mardon skipper.
- There is a lack of information about the status of populations of state candidate species including Townsend's big-eared bat, wolverine, Vaux's swift, white-headed woodpecker, pileated woodpecker, Lewis' woodpecker, black-backed woodpecker, flammulated owl, northern goshawk, golden eagle, California mountain kingsnake,

sharp-tailed snake, western toad, Columbia spotted frog, bull trout, mountain sucker, leopard dace, river lamprey, chinquapin hairstreak and juniper hairstreak.

- Data are needed on habitat needs and limiting factors, demographics and dispersal in western gray squirrel, Oregon spotted frog, golden eagle and mardon skipper.
- A better understanding of the interactions between barred owl and northern spotted owl is needed.
- Taxonomy of the western toad is uncertain, which means that one or more taxa may be in greater decline. Causes of decline are not well understood; distributional data is needed.
- Additional information is needed on the current distribution and abundance of pygmy nuthatch, mountain quail, Pacific lamprey, Propertius' duskywing and chinquapin hairstreak.
- Data are needed on genetic diversity and gene flow in bull trout.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

Habitat loss, conversion, fragmentation and degradation:

- Only 15% of eastern Washington forest is currently in the old growth age class, and nearly all of it is in high elevation national forests or national parks. Maintenance of old growth forest across the landscape is important for at least 1,000 species.
- Grassy and herbaceous balds are rare patch habitats distributed in low and high elevation forests. They often have associated rare species that are vulnerable to certain forest practices and recreation.
- Loss, fragmentation and degradation of oak and mixed oak/conifer habitats to logging, encroachment by conifers and rural development affects western gray squirrel, Lewis' woodpecker, and Propertius' duskywing.
- Remnant stands of old and mature timber that support northern spotted owl, pileated woodpecker and other species are at risk of stand replacement fires.
- Loss of juniper to development and nectar plant destruction from land management practices affects juniper hairstreak.
- Sharp-tailed snake and Larch Mountain salamander are vulnerable to disturbance to rock and talus, woody debris and moisture regime.
- Rural residential development may negatively affect habitat of western gray squirrel and other species.
- The loss and fragmentation of shrub-steppe habitat has resulted in the direct loss and reduced population viability of remaining populations of sage-grouse, Brewer's sparrows and other shrub-steppe obligate wildlife.
- Closing off abandoned mines causes habitat loss of critical maternity roosts and hibernacula for Townsend's big-eared bats.
- Wetland drainage, altered hydrology or succession of wetlands can eliminate habitat of greater sandhill crane, Oregon spotted frog and Columbia spotted frog.
- Mountain quail habitat has been lost or degraded by improperly managed grazing and herbicide use, and development.
- Suburban sprawl is a concern for resource managers, as indicated by the growing number of ranchettes and residential subdivisions in previously managed forest and cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.

Incompatible land management practices:

- Logging and fire suppression, which has created overly dense stands at risk of crown fire, have reduced the quantity and degraded quality of mature ponderosa pine habitat of white-headed woodpecker, Lewis' woodpecker, pygmy nuthatch, flammulated owl and other species.
- Logging, conversion to conifers, and firewood cutting in oak habitats have all negatively impacted western gray squirrels.
- Logging of mature/old timber and reduction in abundance of snags may negatively impacts populations of flammulated owl, northern spotted owl, northern goshawk, Vaux's swift, pileated woodpecker, and black-backed woodpecker.
- Removal of overstory from talus may destroy Larch Mountain salamander habitat.
- Wetlands and meadows may be harmed by improperly managed grazing, haying and water management practices.
- Mowing and haying can disturb nesting greater sandhill cranes and may accidentally destroy nests and crane chicks.
- Improperly managed grazing and herbicide use have degraded mountain quail habitat in some areas.
- Logging, agriculture, road building or other activities that may elevate water temperature, may also alter hydrology, increase sedimentation, and degrade habitat of bull trout, pygmy whitefish, mountain sucker, leopard dace, inland redband trout and westslope cutthroat.
- Improper grazing of meadows and spraying of BTK to control spruce budworm and tussock moth may adversely affect the mardon skipper by destroying host plants.
- Modern agricultural practices often reduce the quality, patch size and connectivity of wildlife habitat in farmlands.

Alien and invasive plant and animal species:

- Reed canary grass thrives in reservoirs and wetland stream outlets where water levels fluctuate and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other animals are not well adapted to spawn or reproduce in reed canary grass thickets.
- Non-native trout introduced as sportfish readily hybridize with native bull trout and westslope cutthroat.
- Western gray squirrels are negatively affected by competition from non-native eastern gray and fox squirrels.
- Predation by bullfrogs and/or introduced predatory fish negatively impact western pond turtle, Oregon spotted frog and Columbia spotted frog; predation by non-native predator fish have eliminated some populations of pygmy whitefish.
- Non-natives turtle threaten native western pond turtles through competition and introduced disease.
- Filbert worms and other alien pests affect acorns needed by western gray squirrel, acorn woodpecker and other wildlife species.
- Alien grasses and weeds affect mardon skipper by reducing availability of native host plants.
- Barred owls have expanded their range into Washington and threaten northern spotted owl through competition for prey and nest sites, hybridization and possibly predation.

Human disturbance and recreational impacts:

- Recreational activities such as offroad recreational vehicles, horses, mountain bikes and even hikers can create unauthorized trails that disturb soil and allow invasive plants to establish.
- The nature and timing of farm disturbances may be increasingly hazardous to wildlife. Tilling, planting and harvesting are becoming more synchronous, widespread and intense, potentially stressing wildlife during critical periods of nesting, rearing and dispersal.
- Backcountry skiers, heli-skiers, snowmobiles and motorized vehicles can disturb or displace wolverine, grizzly bear, and lynx.
- Human disturbance can be a significant problem for certain nest sites of peregrine falcon, bald eagle, greater sandhill crane and golden eagle, and at breeding or maternity roosts, and hibernacula of Townsend's big-eared bat.
- Recreational boating can create disturbance problems for common loon and foraging bald eagle; eagles often avoid foraging in water around stationary boats.

Environmental contaminants:

- Concentrations of DDE, PCBs and dioxins from prey causes reduced reproduction of bald eagle on Columbia River. Eagles, peregrine falcon and prairie falcon concentrate persistent chemicals such as DDE and PCBs that can cause eggshell thinning, making them vulnerable to any persistent toxic chemical.
- Common loons are poisoned by lead fishing sinkers; bald eagle and golden eagle are occasionally poisoned after eating dead or injured waterfowl or other game animals that contain lead shot or bullets.
- Piscicides used to eradicate unwanted fish have eliminated some populations of pygmy whitefish.

Incompatible transportation and energy development:

- Dams and other passage barriers negatively affect bull trout, river lamprey and Pacific lamprey, and water level manipulations from hydroelectric dams can affect common loon.
- Golden and bald eagles and other raptors are susceptible to electrocution on powerlines.
- Western gray squirrel, western toad and western pond turtle are susceptible to roadkill mortality.
- Highway corridors and development (including Highways 20, 2, 12, and I-90) fragment suitable habitat and create barriers or impediments to movement for wolverine, grizzly bear, lynx, wolves and other mammals.
- Destruction of talus for roads and by roads affects Larch Mountain salamander, sharp-tailed snake and rare snails.
- Wind energy projects may cause mortalities to many species of birds and bats.

Inadequate water quantity and quality:

- Water level fluctuations sometimes negatively impact greater sandhill crane nests and Oregon spotted frogs.



CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protect known populations, augment/reintroduce populations, control and monitor mortality and enhance food/prey.

- Implement recovery actions for western gray squirrel, lynx, fisher, sandhill crane, western pond turtle, northern spotted owl, grizzly bear and bull trout.
- Develop or finalize recovery plans for the gray wolf, northern spotted owl, Oregon spotted frog, bull trout and mardon skipper.
- Develop management plans for the state sensitive species such as common loon, peregrine falcon, Larch Mountain salamander and pygmy whitefish.
- Continue head starting, captive breeding and reintroductions of western pond turtles.
- Assess feasibility of augmenting populations of western gray squirrel, Oregon spotted frog and mardon skipper and conduct translocations as needed.
- Participate in the North Cascades Grizzly Bear Subcommittee to implement recovery actions.
- Prepare interagency management response guidelines for wolves to document sightings and address conflicts.
- Complete the Washington Bat Conservation Plan.
- After evaluating success of fisher reintroduction to the Olympic Peninsula, conduct additional reintroductions into the Cascades.
- Monitor the impacts of mange on western gray squirrel populations.
- Assess other species for possible addition to the state candidate list.
- Consider adding winter dens of snakes to protected wildlife code.
- Monitor population trends of the western gray squirrel, western pond turtle, northern spotted owl, greater sandhill crane, Oregon spotted frog, mardon skipper and bull trout to determine whether recovery objectives are being met.
- Determine the status of candidate species including Townsend's big-eared bat, wolverine, Vaux's swift, white-headed woodpecker, pileated woodpecker, Lewis' woodpecker, black-backed woodpecker, flammulated owl, northern goshawk, golden eagle, California mountain kingsnake, sharp-tailed snake, western toad, Columbia spotted frog, mountain sucker, leopard dace, river lamprey, chinquapin hairstreak and juniper hairstreak.
- Monitor any colonizing wolves to determine establishment of packs and habitat use.
- Conduct periodic surveys of sensitive species including Larch Mountain salamander, common loon and pygmy whitefish.
- Conduct post-downlisting surveys and monitor peregrine and bald eagle populations for signs of decline that could result from bioaccumulation of contaminants.
- Investigate limiting factors, impacts of land management, demographics and dispersal of western gray squirrel, Oregon spotted frog, sandhill crane, western pond turtle and mardon skipper.
- Determine the abundance and distribution of pygmy nuthatch, acorn woodpecker, mountain quail, Propertius' duskywing, westslope cutthroat, inland redband trout and Pacific lamprey.
- Develop efficient survey methods for river lamprey and Pacific lamprey, develop methods to differentiate between species of lamprey, and identify potential obstacles and develop methods to pass barriers.
- Evaluate effect of timber harvest at landscape scale on occupancy of habitat by northern spotted owl and barred owl.
- Investigate the systematics of western toad using DNA techniques.
- Investigate the genetic diversity of western gray squirrel populations as needed for translocations.

- Investigate the genetic diversity and gene flow in bull trout populations.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update Ecoregional Assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.

Protect, restore and connect habitats:

- Identify and protect essential habitat through management agreements, easements, or acquisitions as needed to recover listed species including western gray squirrel, greater sandhill crane, Oregon spotted frog and western pond turtle.
- Preserve and restore wet meadows and wetlands for greater sandhill crane, western pond turtle, Oregon spotted frog and Columbia spotted frog through incentives, management programs, or acquisitions. Conserve beaver populations and dynamic stream processes.
- Protect habitat of sharp-tailed snake, California mountain kingsnake and ***juniper hairstreak*** from residential and recreational development through livestock fencing, easements, conservation agreements, management plans and acquisitions.
- Identify, protect and restore oak and pine habitats of western gray squirrel and other listed and candidate species from incompatible logging, residential and recreational development through management agreements, easements and acquisitions.
- Reduce mortalities of eagles and other raptors through modification of electric transmission and distribution lines.
- Continue to require bald eagle habitat plans that include retention of trees. Enforce/strengthen Shoreline Management Act
- Identify and protect preferred roost and hibernacula sites for Townsend's big-eared bat and limit access to these areas.
- Identify and restore habitat for mountain quail.
- Protect rare habitat types such as grassy and herbaceous balds, aspen stands, snag patches, caves, cliffs and talus.



- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas, and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented, or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers and estuaries.

Improve land management practices:

General

- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Fire management

- Work with public agencies and private landowners to reduce the potential destructive impact of wildfires on native habitats by incorporating measures such as fire breaks and prescribed burning into wildlife and land management plans.
- Coordinate with public land managers on the use of controlled fire regimens and stand management practices. Attempt to simulate natural disturbance regime and restore proper ecological function. Consider impacts to local wildlife in each burn plan, including timing, size and location of the burn.

Forest management

- Work with the Forest Practices Board and both public and private forest landowners to properly design and implement current forest practices rules, including the Forests and Fish Agreement to protect fish, wildlife and habitat.
- Protect existing old growth, nesting sites, large snags and forest stand age and structure as needed for spotted owl, Vaux's swift, northern goshawk, western gray squirrel, pileated woodpecker, Lewis' woodpecker, and black-backed woodpecker.
- Maintain mature and old-growth ponderosa pine and restore degraded pine forests by thinning dense understory fir and return natural fire regime where feasible for white-headed woodpecker, Lewis' woodpecker, flammulated owl and pygmy nuthatch.
- Maintain stream buffers during timber harvest and conduct proper land-use management to protect mountain sucker, bull trout, inland redband trout, leopard dace, and pygmy whitefish.
- Do not remove overstory from talus in range of Larch Mountain salamander
- Protect and maintain chinquapin stands in the Gifford Pinchot National Forest.
- Maintain and enforce Forest Practice rules protecting bald eagle nests and roost sites, and northern spotted owl nest sites.
- Protect remaining old growth conifer and hardwood stands to benefit late successional species, and manage some stands on long rotations (>200 years).
- Work with the Department of Natural Resources and the State Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the State Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem functions. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions. Retain snags, downed woody debris and a complement of live trees in harvested areas. Sensitive areas such as wetlands, remnant old growth and wildlife breeding sites should not be disturbed.
- Encourage the development of selective harvest policies and guidelines on both public and private forest land that will leave adequate components of old growth habitat such as snags and downed wood and some live trees as habitat for associated wildlife such as pileated woodpecker, Vaux's swift, flammulated owl and white-headed woodpecker.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Support implementation and enforcement of the Washington Forest Practices Act to accomplish habitat conservation and regeneration on both state and private forest lands.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.
- In dry site forests, implement silvicultural practices that improve stand age-class and structural diversity. Retain large dominant oaks, ponderosa pine and Douglas fir and standing dead and dying trees, create snags instead of removing trees, and leave fallen trees, limbs and leaf litter for foraging, nesting and denning sites. Use prescribed burns to maintain open savannah in appropriate areas.

Grazing and agricultural practices

- Work with public and tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland and shrub-steppe understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Do not disturb nesting sandhill cranes with haying or grazing or drain wet meadows.
- Prevent grazing and forest practices that are incompatible with conserving mountain quail habitat.
- Ensure that grazing leases on state lands comply with HB1309 "Ecosystem Management Standards" to maintain fish and wildlife habitat.

Control and prevent introduction of alien and invasive species:

- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Conduct limited control of eastern gray and fox squirrels that compete with ***western gray squirrel***.
- Control bullfrogs and predatory fish as needed for western pond turtle, Oregon spotted frog and Columbia spotted frog.
- Control weeds and alien grasses negatively affecting mardon skipper and juniper hairstreak habitat.
- Enforce restriction on transplantation and release of fish, non-native turtles, bullfrogs, etc. to protect western pond turtle, Oregon spotted frog, Columbia spotted frog and pygmy whitefish.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout and westslope cutthroat trout and native amphibians and reptiles. Avoid introduction of rainbow trout or only introduce sterile fish where westslope cutthroat are found. Avoid introduction of non-native trout to protect bull trout from hybridization, competition and predation.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and coordination of weed control efforts on both public and private lands using environmentally sound methods.
- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.



- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.

Control and monitor disturbance:

- Protect Townsend's big-eared bat and nesting peregrine falcon, golden eagle and bald eagle through use and access restrictions on public lands as needed. Work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting. Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrines falcons.
- Limit access to roost and hibernacula sites for Townsend's big-eared bat.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats such as montane wetlands, bogs and prairies.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.

Control and prevent environmental contamination:

- Facilitate use of nontoxic alternatives to fishing sinkers to protect common loons.
- Work with other agencies to reduce and remediate sources of contaminants that contribute to prey contamination for bald eagle, peregrine falcon, etc.
- Do not use piscicides to eradicate unwanted fish in lakes with pygmy whitefish.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments whenever possible, and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Continue to place a priority on actions to prevent and respond to oil and hazardous material spills.

Improve transportation and energy development:

- Prevent construction of roads and buildings within 0.5 mile of greater sandhill crane nesting territories.
- Minimize density of logging roads in habitat of grizzly bear.
- Discourage use talus for roads to prevent destruction of Larch Mountain salamander, California mountain kingsnake and sharp-tailed snake habitat.
- Reduce mortalities of eagles and other raptors through modification of electric transmission and distribution lines.
- Monitor and minimize wildlife mortalities from wind turbines.
- Work with the Washington Department of Transportation to locate highways away from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife that need passage, such as gray wolf, wolverine, lynx, grizzly bear and other large mammals, western pond turtle, western toad and western gray squirrel.

Improve water quantity and quality:

- Discourage water projects that impact nesting habitat of greater sandhill cranes.
- Reduce sedimentation and pollution to conserve bull trout, pygmy whitefish, mountain sucker, leopard dace, westslope cutthroat, inland redband trout, river lamprey and ***Pacific lamprey***.
- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of wetland habitat.
- Where possible, restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as conserving beaver populations and dynamic stream processes to benefit species like Oregon spotted frog, western toad and Columbia spotted frog.
- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts, or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.



Improve coordination, planning, permitting and mitigation:

- Continue to require bald eagle habitat plans that require retention of trees. Enforce/strengthen Shoreline Management Act
- Protect nesting northern spotted owl, golden eagle and greater sandhill crane by maintaining buffer zones of no activity during nesting.
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.

- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, Shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.
- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Represent WDFW's conservation interest on interagency recovery teams and working groups.

Improve enforcement of laws and regulations:

- Protect northern spotted owl, grizzly bear, gray wolf and other listed wildlife through enforcement, education and outreach.
- Enforce prohibition of killing bald eagle and non-permitted possession of parts through investigation and vigorous prosecution.
- Limit access to roadless, wilderness and primitive areas; prevent disturbance of grizzly bear, lynx and denning areas for wolverine.
- Reduce illegal capture for pet trade of California mountain kingsnake
- Enforce nontoxic shot requirements for waterfowl hunting to protect bald eagle and peregrine falcon.
- Enforce restriction on transplantation of fishes to protect Oregon spotted frog, Columbia spotted frogs and other native amphibians, and pygmy whitefish, leopard dace and mountain sucker.
- Enforce harvest restrictions for bull trout.
- Enforce recreational access restrictions on public lands and aquatic areas.

Improve landowner assistance:

- Work with large and small timber companies and landowners to accomplish habitat conservation through nonregulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity, such as wet meadows, moist talus and oak woodland, and protect these areas through landowner incentives and other nonregulatory programs.
- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife, and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.
- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands, shrub-steppe and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.
- Develop, periodically update, and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Develop or disseminate education materials about food and garbage to avoid conflicts with grizzly bear.
- Disseminate education materials to avoid accidental shooting of grizzly bear due to mistaken identity.
- Reduce the amount of illegal capture of California mountain kingsnake for pets.
- Develop education programs targeted to reduce disturbance of nesting **common loon** and bald eagle by boaters.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and



environmentally-aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.

- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.



Acorn woodpecker.

OKANOGAN ECOREGION



PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The Washington portion of the Okanogan ecoregion extends from the Cascade crest in the North Cascades east to the Selkirk Mountains. It includes the Methow and Okanogan valleys, the Okanogan Highlands, and the Colville and Spokane valleys. Roughly 14 percent of Washington is within this ecoregion.

Geology

The Okanogan is considered to be a transitional ecoregion because it encompasses the meeting place of very distinct and dissimilar adjacent areas. The north Okanogan is the highest and most rugged part of the ecoregion, with peaks rising to more than 8,900 feet. The high mountains give way to a series of valleys with the lowest elevations around 750 feet. To the east, the mountains are more rounded and include the Kettle Range and Huckleberry Mountains as prominent features. Continental and alpine glaciers played a major role in shaping the landforms of this ecoregion.

Climate

This ecoregion has the coldest climate in the state. The western portion is in the rain shadow of the Cascade Mountains, while the eastern portion is in a zone of increasing precipitation created by the Rocky Mountains. The ecoregion is influenced by the extremes of hot, dry air from the Columbia Basin in the summer and cold, dense arctic air in the winter. Annual precipitation is variable, from less than 12 inches in the Okanogan Valley to 50 to 90 inches in the Cascades. Most of the ecoregion falls within a 14- to 24-inch precipitation zone. There are fairly steep temperature and precipitation gradients from the mountains to the valleys within this ecoregion.

Habitat and Plant Associations

Coniferous forests dominate the mountain ridges and low hills, while valleys and lowlands are often non-forested. Compared to forests west of the Cascade crest and in the Canadian Rockies, the Okanogan conifer forests are more open and less continuous, consisting of smaller stands. Douglas-fir and ponderosa pine are characteristic of the ecoregion's forests.

They transition to shrub-steppe in the Okanogan and Methow Valleys, and to native grasslands in the low valleys of the eastern part. Subalpine fir and Engelmann spruce forests occur at higher elevations. Whitebark pine, lodgepole pine, and subalpine larch form parklands in the highest elevations, often associated with dry alpine or subalpine meadows. The moister mid-elevation forests are dominated by Douglas-fir, with western larch, western white pine or quaking aspen as common components.

The landscape of the Washington portion of the Okanogan ecoregion is considered to be relatively intact, dominated by natural or semi-natural vegetation. It contains high concentrations of rare plant species and is important for wide-ranging listed carnivore species, including grizzly bear, gray wolf, lynx and wolverine. The low elevations of the Okanogan and Similkameen river valleys, where dry climate and desert-like habitats are northern extensions of the Great Basin, are particularly important for shrub-steppe species. The Okanogan ecoregion is the only conduit for wildlife movement between the dry native grasslands of the British Columbia interior and the desert areas of the western United States. This area of rich biodiversity is of international importance.

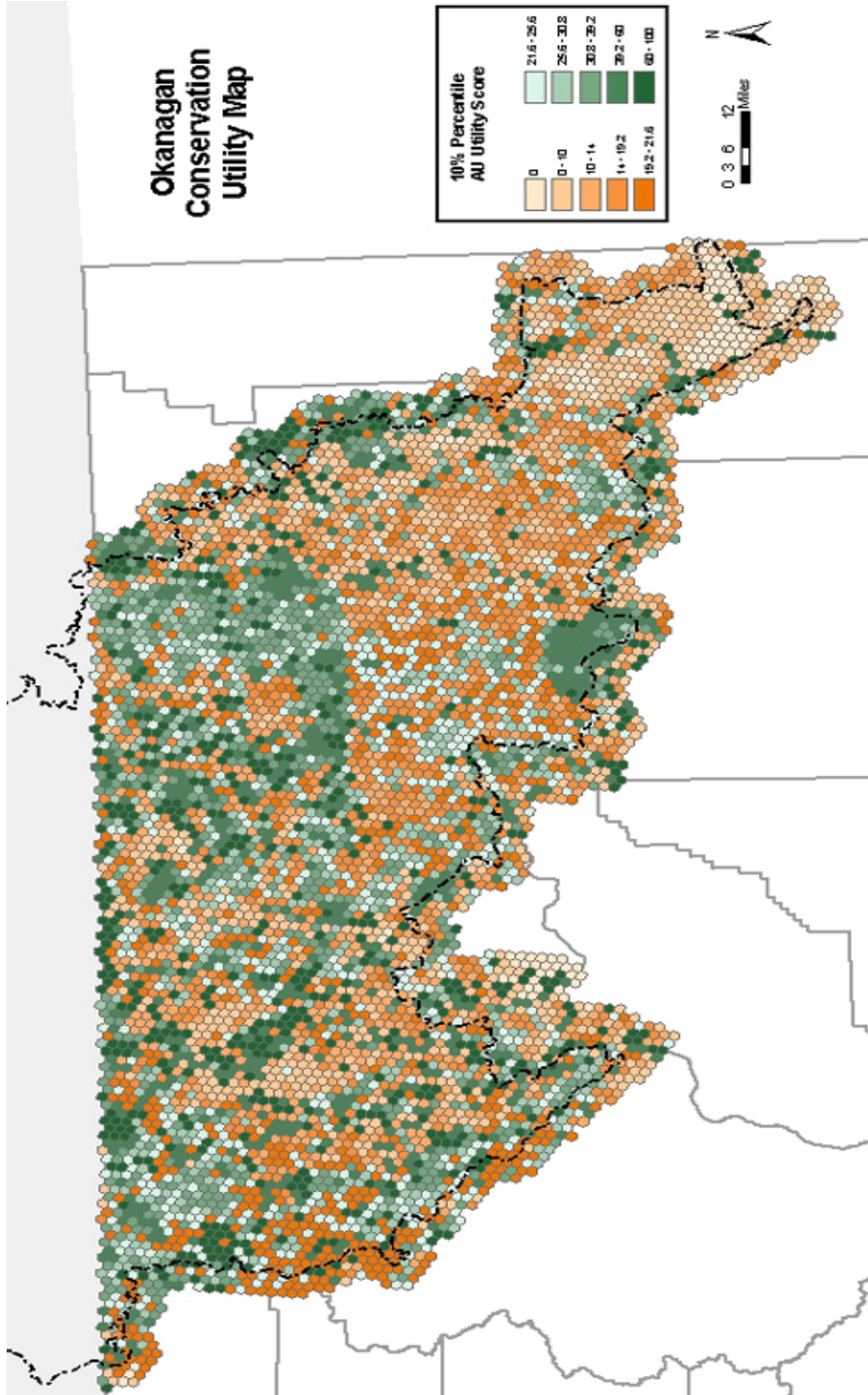
Fish and Wildlife Diversity

Wildlife in the Okanogan ecoregion is relatively diverse. Due to the warm, dry summers, cold winters, variety of landforms, and proximity to the Columbia Plateau, the ecoregion contains about 100 distinct wildlife habitat types. Mammal species include several herbivores, such as California bighorn sheep, mountain goat, and mule deer as well as snowshoe hare and northern flying squirrel. The pallid bat, widespread in the Great Basin, also extends its range into the drier portions of the ecoregion. Native bird species diversity is tremendous, ranging from alpine species such as spruce grouse, ptarmigan and great gray owls to grassland species such as sharp-tailed grouse and long-billed curlews, as well as species indigenous to the Great Basin, such as sage thrashers and burrowing owls. Abundant water systems provide for a high population of waterfowl, osprey, and bald eagle. Other uncommon species include harlequin duck in higher elevation rivers and bobolinks in agricultural lands. Some species that occur in the Washington portion are listed species in Canada, such as the yellow-breasted chat, western screech owl, and white-headed woodpecker. Amphibians and reptiles exhibit considerable variability in the ecoregion. Reptiles include western painted turtles, western rattlesnakes, and western yellow-bellied racers, while western toads, Great Basin spade foot toads, and tiger salamanders are among the amphibians.



While the CWCS focuses on wildlife diversity, the ecoregional assessments address the full range of Washington’s biological diversity. One product of the ecoregional assessment, the conservation utility map, depicts the relative biodiversity value of landscapes or watersheds within the ecoregion. A sample map, titled Conservation Utility Scores, is shown below for the Northwest Coast ecoregion (Figure 12). The utility scores indicate both the biodiversity value of an assessment unit (AU) and its suitability for conservation. The AU varies by ecoregion and is either a hexagon or a watershed. The scores are generated with a computer algorithm under the assumption that all AUs are not equally suitable for conservation (a suitability index was used). For instance, lands adjacent to intensive agriculture or residential development are considered less suitable for conservation than lands adjacent to undisturbed forest. The algorithm assigns a high utility score to AUs that contain rare targets (species or communities), contain a large amount of a target (i.e., has high representation of a target), or has a high number of targets (i.e., has high richness). When a set of AUs have similar biological contents, the algorithm uses the suitability index to choose the best AU from the set. AUs with a score of 100 are either irreplaceable or are the most suitable place to conserve particular targets. Refer to Appendix 12 for a description of how these maps were developed.

Figure 27.



LAND OWNERSHIP

The Okanogan region in Washington is sparsely populated. Okanogan County, which makes up most of the ecoregion in Washington, is the third largest county in the continental United States, yet it has a population of only 39,134 people. The only large urban area in the Washington portion of the ecoregion is Spokane, located on the southeast edge of the ecoregion. Outside of Spokane, most development is agricultural and/or concentrated near Colville, Winthrop, Omak and other towns in the Colville, Methow and Okanogan valleys.

Human land use, like vegetation, tends to follow an elevational gradient in the Okanogan ecoregion. In the higher elevations, particularly the alpine and subalpine zones, human activities partially reflect recreation and wildlife values. Simultaneously, mineral exploration and development continues to be relatively extensive throughout the ecoregion. In the southern portion of the ecoregion, woodland grazing, forestry, hunting and recreation are also prevalent in the higher elevations. Forestry and agriculture occur in the lower, warmer zones. Grazing, forage production, orchards, water-oriented recreation, and tourism represent the major lower elevation activities.

Approximately 43 percent of the Okanogan ecoregion in Washington is in federal or state ownership. The largest federal owner is the US Forest Service, with holdings in the Wenatchee-Okanogan and Colville National Forests of almost 3,100 square miles, or 32% of the Washington portion of the ecoregion. The Washington Department of Natural Resources is the second-largest public landowner, with 735 square miles under its management and control. The Washington Department of Fish and Wildlife manages about 100 square miles, including the Methow and Sinlahekin Wildlife Areas, both of which were originally purchased as mule deer range, but which are now managed as habitat for a variety of fish and wildlife species and recreational pursuits. WDFW is also currently working with other Canadian and American partners to protect and manage the cross-border Okanogan-Similkameen corridor, which is the only conduit for wildlife movement between the dry native grasslands of interior British Columbia and the Great Basin areas of Washington and other western states. The Colville and Spokane Indian reservations, which include both tribal and private ownership, total 2,100 square miles, or 22% of the entire ecoregion. Figure 28 maps land ownership classes for the Okanogan ecoregion.

Okanogan Ecoregion

Land Ownership Classes

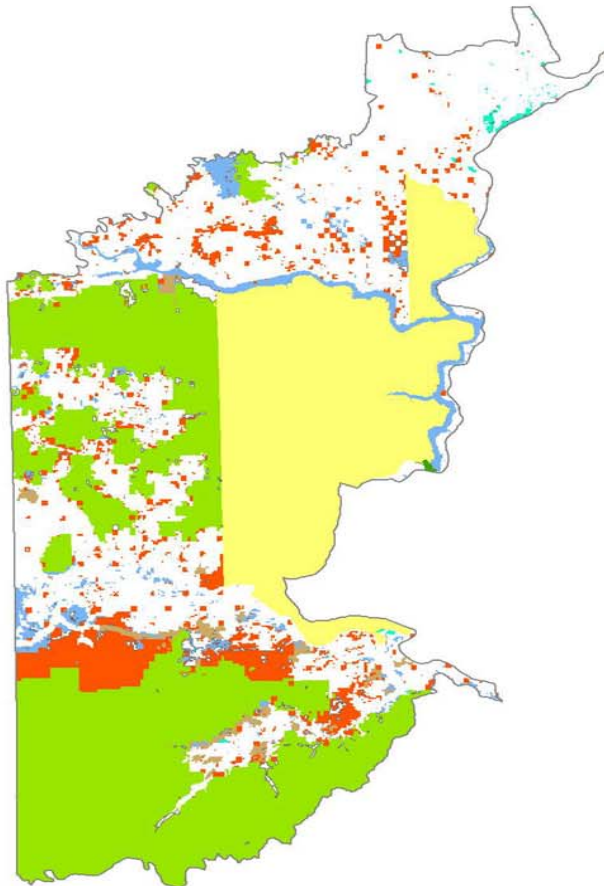
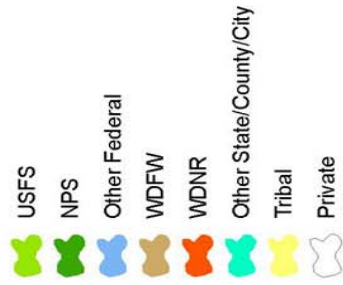


Figure 28.



ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the Okanogan ecoregion include:

- Colville Confederated Tribes
- Okanogan, Ferry and Stevens Counties
- Spokane Indian Tribe
- U.S. Bureau of Land Management
- U.S. Bureau of Reclamation
- U.S. Fish and Wildlife Service
- USDA Forest Service (Wenatchee-Okanogan and Colville National Forests)
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Rocky Mountain Elk Foundation, Audubon Washington, and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the Okanogan ecoregion. Important planning efforts affecting conservation in the Okanogan ecoregion include:

- Interior Columbia Basin Management Project
- Methow, Okanogan, Upper Columbia, Sanpoil and Spokane Subbasin Plans (2004)
- Northwest Forest Plan (1994)
- USFWS Draft Bull Trout Columbia Basin DPS Recovery Plan (2002)
- USFWS Grizzly Bear Recovery Plan (1993)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Draft Okanogan Regional Wildlife Area Management Plan
- WDFW Ferruginous Hawk Recovery Plan (1996)
- WDFW Fisher Recovery Plan (2005)
- WDFW Game Management Plan (2003)
- WDFW Lynx Recovery Plan (2001)
- WDFW Northern Leopard Frog Status Report (1999)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Pygmy Whitefish Status Report (1998)
- WDFW Sandhill Crane Recovery Plan (2002)
- WDFW Sharp-tailed Grouse Management Plan (1995)
- WDFW Sharp-tailed Grouse Status Report (1998)
- WDFW Western Gray Squirrel Recovery Plan (2005)

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the Okanogan ecoregion.

Species of Greatest Conservation Need

The following species list for the Okanogan ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two, Approach and Methods, as well as in Appendix 3. Species listed below are found in the Okanogan ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Mammals												
Townsend's big-eared bat			x							x	C	S3
White-tailed jackrabbit			x				x				C	S2
Western gray squirrel			x				x				T	S2
Gray wolf	?									x	E	S1
Grizzly bear		x							x		E	S1
Fisher	x							x			E	SH
Wolverine		x						x			C	S1
American badger			x				x				G	S4
Lynx			x							x	T	S1
Birds												
Common loon			x					x			S	S2
Western grebe			x				x				C	S3
American white pelican			x						x		E	S1
Great blue heron			x							x	M	S4
Trumpeter swan			x						x		G	S3
Northern pintail					x		x				G	S3
Redhead			x					x			G	S3
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Prairie falcon			x							x	M	S3
Sharp-tailed grouse			x				x				T	S2
Sandhill crane (greater)		x							x		E	S1
Flammulated owl			x							x	C	S3
Burrowing owl			x				x				C	S2
Great gray owl			x							x	M	S2
Vaux's swift			x				x				C	S3
Lewis' woodpecker			x				x				C	S3
White-headed woodpecker			x				x				C	S2
Black-backed woodpecker			x							x	C	S3
Pileated woodpecker				x						x	C	S4
Pygmy nuthatch			x							x	N	S3
Sage thrasher			x				x				C	S3
Loggerhead shrike			x				x				C	S3
Sage sparrow			x				x				C	S3
Reptiles												
Pygmy horned lizard				x						x	N	S3
Sagebrush lizard			x				x				C	S2
Amphibians												
Tiger salamander				x						x	M	S3
Western toad				x			x				C	S3
Northern leopard frog			x				x				E	S1
Columbia spotted frog			x							x	C	S4
Fish												
Westslope cutthroat				x				x			G	G4
Upper Columbia steelhead											C	G5
Inland redband trout						x				x	G	G5
Bull trout						x				x	C	G3
Upper Columbia fall chinook											G	G5
Pygmy whitefish						x				x	S	S1
Leopard dace						x				x	C	S2
Invertebrates												
Silver-bordered fritillary (butterfly)			x							x	C	S3
Subarctic darner (dragonfly)			x							x	N	S2

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Boreal whiteface (dragonfly)		x								x	N	S1
Subarctic bluet (dragonfly)			x							x	N	S2
California floater (bivalve)			x				x				C	S1
Winged floater (bivalve)			x				x				N	G3
Oregon floater (bivalve)			x				x				N	S3
Western ridged mussel			x				x				N	S2

* Status Codes

E = endangered

T = threatened

S = sensitive

C = candidate

M = monitor

** WNHP Codes (S = state, G = global)

1 = critically imperiled

2 = imperiled

3 = vulnerable to extirpation or extinction

4 = apparently secure

5 = demonstrably widespread, abundant and secure

Species Conservation in the Okanogan Ecoregion

Species of Greatest Conservation Need (SGCN) found in the Okanogan ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. Conservation actions are recommended for these species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

Ecoregional Habitat Overview

Vegetation in the Okanogan ecoregion varies along an elevational gradient. Engelmann spruce, subalpine fir and lodgepole pine generally dominate subalpine areas. Lower elevation forests typically support quaking aspen and Douglas-fir associated with pine grass understories. In the valley bottoms, Douglas-fir, ponderosa pine, and pine grass grow in a matrix of bluebunch wheat grass, Idaho fescue and sagebrush. Additionally, native grasslands and shrub-steppe can be found in the driest areas and include such species as bluebunch wheat grass, blue grass, sagebrush, rabbitbrush, antelope bush and big sagebrush. This ecoregion contains the northern continental range extensions of many species of reptiles, amphibians, insects and plants. Figure 29 maps wildlife habitat classes for the Okanogan ecoregion.

The following habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the Okanogan ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Montane Mixed Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine Forest and Woodlands
- Upland Aspen Forest
- Subalpine Parkland
- Alpine Grasslands and Shrublands
- Eastside (Interior) Grasslands
- Shrub-steppe
- Dwarf Shrub-steppe
- Agriculture, Pasture and Mixed Environs
- Urban and Mixed Environs
- Open Water: Lakes, Rivers, Streams
- Herbaceous Wetlands
- Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands

Okanogan Ecoregion

Wildlife Habitat Classes

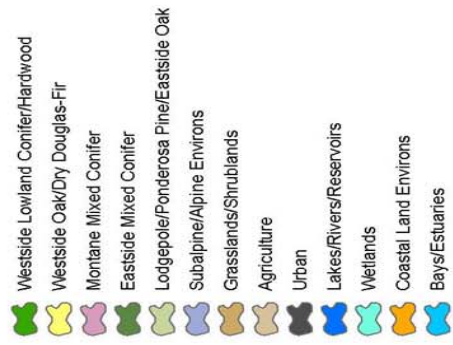


Figure 29.



Priority Habitats in the Okanogan Ecoregion

The following three habitat types have been identified as the highest priority for current conservation action in the Okanogan ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the Okanogan Ecoregional Assessment and the subbasin plans listed in the "Major Plans" section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two: Approach and Methods.

- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine Forest and Woodlands
- Upland Aspen Forest
- Shrub-steppe and Eastside (Interior) Grasslands
- Eastside (Interior Riparian-Wetlands)

Lodgepole Pine Forest and Woodlands

Lodgepole pine forest, under natural conditions, originates with fire and forms single-canopied early to mid-seral stands, but it is also associated with other montane conifers. This habitat generally includes grassy undergrowth and occurs at 3,000 to 9,000 feet elevation. Because lodgepole pine cannot reproduce under its own canopy, old unburned stands are replaced by shade-tolerant conifers. Fire suppression has left many lodgepole pine habitats unburned to develop into more multilayered stands.

Lodgepole pine is important for lynx because the young, regenerating stands with high stem densities are optimal habitat for snowshoe hare, the main prey of the threatened lynx. Because the Okanogan is the heart of lynx range in Washington, most of the public and private forests have lynx management plans that theoretically provide for maintaining suitable habitat through time. Fire, succession, wind, insects, harvest, road construction, livestock grazing and recreational development all change the character of the landscape and must be taken into account when attempting to manage wildlife habitat for wide-ranging species.

Selected Species Closely Associated with Lodgepole Pine Forest and Woodlands in the Okanogan Ecoregion

Gray wolf	Grizzly bear
Lynx	Black-backed woodpecker
Great gray owl	Northern goshawk

Ponderosa Pine Forest and Woodlands

Historically, old-growth ponderosa pine forests occupied large areas between the shrub-steppe zone and moister forest types at higher elevations. Large, widely spaced, fire-resistant trees and an understory of forbs, grasses, and shrubs characterized these forests. Periodic fires maintained this habitat type. With human settlement, most of the old pines were harvested for timber, and frequent fires have been suppressed. As a result, much of the original forest has been replaced by dense second growth of Douglas-fir and ponderosa

pine with little understory. Large, mature ponderosa pine and Douglas-fir are harvested in much of this habitat type. Under most management regimes, typical tree size decreases and tree density increases. In some areas, patchy tree establishment at forest-steppe boundaries has created new woodlands, replacing shrub-steppe in the presence of long-term fire suppression.

Selected Species Closely Associated with Ponderosa Pine Forest and Woodlands in the Okanogan Ecoregion	
Flammulated owl	Northern goshawk
Great gray owl	Pygmy nuthatch
White-headed woodpecker	Western gray squirrel

Upland Aspen Forest

Quaking aspen groves are a limited habitat type in Washington but have high wildlife use. They occur on well-drained mountain slopes and in seral stands in the lower Eastside Mixed Conifer Forest and on riparian and poorly drained soils within Ponderosa Pine Forest. Aspen stands are typically two-tiered with a tree layer growing over forb, grass or low-shrub undergrowth. Because aspen is not shade tolerant, conifers can invade these stands.

Fire plays an important role in maintaining this habitat. Aspen sprouts after fire and spreads into large clonal or multi-clonal stands. With fire suppression aspen stands are less common than they were before 1900. The aspen sprouts, leaf buds and catkins are nutritious food for a variety of wildlife including sharp-tailed grouse, western gray squirrel, songbirds and deer.

Selected Species Closely Associated with Upland Aspen Forest in the Okanogan Ecoregion	
Sharp-tailed grouse	Grizzly bear
Northern goshawk	Western toad

Shrub-Steppe and Eastside (Interior) Grasslands

Historically, a mosaic of shrub or grass-dominated steppe vegetation occurred throughout the driest areas of the ecoregion. Shrublands were co-dominated by shrubs and perennial bunchgrasses with a microbiotic crust of lichens and mosses on the surface of the soil. This crust provides stability to shifting soils caused by natural erosion. Today, the arid steppe vegetation zone occupies the central portion of the Okanogan ecoregion. The average shrub cover is generally between 5% and 20%.

Dominant shrubs were sagebrush and bitterbrush. Bunchgrasses were mostly bluebunch wheatgrass, Idaho fescue, needle and thread grass, and Sandberg's bluegrass. Soils, climate and topography created distinct plant communities that paired shrub species with specific bunchgrasses across the landscape.

**Selected Species Closely Associated with
Shrub-steppe and Eastside (Interior) Grasslands
in the Okanogan Ecoregion**

Burrowing owl	Sagebrush lizard
Sharp-tailed grouse	Prairie falcon
White-tailed jackrabbit	Sage sparrow
Sage thrasher	Pygmy horned lizard

Eastside (Interior) Riparian-Wetlands

Historically, riparian-wetland habitat was characterized by a mosaic of plant communities occurring at irregular intervals along streams and dominated by various combinations of grass-forbs, shrub thickets, and mature forests with tall deciduous trees. Beaver activity and natural flooding increased the quality and distribution of riparian-wetlands. Today, shallow water habitats are typically connected to the mainstem of the river via culverts or small channels and provide special wildlife values.

Natural flooding regimes, which promote important ecological process in riparian areas, were altered by the development of hydropower on the Columbia River. In general, there has been a decline in the extent and diversity of riparian habitats.

Riparian zones play many essential roles in maintaining ecosystem health and integrity. They provide connectivity between aquatic and upland habitats, moderate stream temperature through shading, maintain water quality by filtering pollutants and stabilizing banks, and supply in-stream nutrients through insect and vegetative inputs. Additionally, riparian zones act to “meter” water delivery by holding water in plant root wads and soils, gradually releasing that moisture as humidity and groundwater. Riparian zones also assist in recruitment of large woody debris, which creates instream pools and channel complexity. In addition to the role riparian zones play in moderating and improving overall habitat conditions, many species of fish and wildlife depend directly on riparian zones to provide cover and forage.

**Selected Species Closely Associated with
Eastside (Interior) Riparian-Wetlands
in the Okanogan Ecoregion**

Great blue heron	Columbia spotted frog
Northern leopard frog	Sandhill crane
Silver-bordered fritillary butterfly	Tiger salamander

CONSERVATION PROBLEMS

Timber harvest, urbanization, flood control, water extraction, and agriculture have been the major causes of habitat alteration. These activities often result in loss or degradation of wildlife habitat through construction of roads, dispersed residential developments, reduced wildlife access to streams, and changes to vegetative communities.

Forest Practices

Forest practices including extensive timber harvest in sections of the Okanogan ecoregion have negatively impacted both fish and wildlife habitat in the ecoregion's watersheds. Timber harvest changes upland and riparian vegetative cover and influences snow accumulation and melt rates. It also contributes to fragmentation of habitat, soil erosion, sediment delivery to creeks and streams, and channel simplification from loss of large woody debris recruitment within the riparian zone. Native plant communities may be replaced by alien species following timber harvest. Road building associated with timber harvest further exacerbates erosion, habitat fragmentation, and creates barriers to fish passage if culverts are impassable.

Alteration of Natural Fire Regimes

Human activities have increased the number of fire starts, but historic fire control policies have kept the size of fires small, resulting in a buildup of fuel in the forested uplands of the ecoregion. Occasional intense, stand-replacing fires occur instead of historically frequent, low-intensity fires. This change in the fire regime has resulted in changes in the composition of the forest and plant communities (especially the spread and proliferation of mixed-forest conifer species within ponderosa pine communities), and in the related capacity for forest soils to store and transport water.

Agricultural Practices

Conversion of shrub-steppe and native grasslands to agricultural uses and improperly managed livestock grazing reduce habitat diversity and function through removal of steppe vegetation, resulting in invasion of alien vegetation. Annual grasses and noxious weeds such as cheatgrass and knapweeds either supplant and/or radically alter entire native bunchgrass communities, significantly reducing wildlife habitat quality. Cheatgrass spreads after wildfires eliminate sagebrush.

Riparian areas in the Okanogan ecoregion have been lost or degraded because of logging, agriculture, improperly managed grazing and residential development that affects stream banks, water quality, water quantity, and overall habitat continuity and complexity. This leads to increased erosion, which in turn, increases sedimentation. Improperly managed livestock grazing compacts soil, contributes to stream bank destabilization, affects compositions of riparian plant communities, and slows recovery of damaged riparian habitat. Undesirable forb species, such as stinging nettle and horsetail, increase with livestock use. Riparian habitat losses also contribute to higher water temperatures in summer months and lower temperature in winter months.

Residential Development

Residential development is rapidly expanding into natural landscapes and is among the most significant long-term threats to conservation targets in the Okanogan ecoregion. Many conservation lands are owned and managed by public agencies, but a significant portion of low-elevation valleys and woodlands, riparian areas and montane grasslands are in private ownership and available for development.

The following additional habitat and species conservation problems have been identified in the Okanogan ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, and limited population size and distribution.

- Populations of western gray squirrel, grizzly bear, gray wolf, fisher, lynx, common loon, American white pelican, bald eagle, peregrine falcon, sharp-tailed grouse, greater sandhill crane, northern leopard frog, and pygmy whitefish have declined to the point that they are listed as endangered, threatened, or state sensitive.
- Small population sizes and loss of genetic diversity are problems in grizzly bear, wolverine, and lynx, and are a concern in other species reduced to isolated populations, including western gray squirrel, sharp-tailed grouse, sagebrush lizard, subarctic darter, boreal whiteface, subarctic bluet, California floater, winged floater, and Oregon floater.
- Tularemia and other diseases may be involved in the decline of white-tailed jackrabbits.
- The expansion of West Nile Virus into Washington poses a threat to sharp-tailed grouse.
- Illegal persecution and harvest occurs for gray wolf, grizzly bear, American white pelican, bald eagle, and migrating and spawning fish species of concern.
- Redhead, northern pintail, and bull trout are susceptible to overharvest.
- Capture as pets reduces the abundance of pygmy horned lizard.
- Capture of larva for use as fish bait hurts tiger salamander populations.
- Declines of native fish populations that serve as hosts for the parasitic larval stages of some bivalves has negatively impacted California floater, winged floater, and Oregon floater.
- Taxonomic relationships of California floater, winged floater, Oregon floater, and western ridged mussel need additional study.

Lack of biological information on species and habitats:

- Adequate information is lacking on the population status of state candidate species, including Townsend's big-eared bat, white-tailed jackrabbit, wolverine, western grebe, northern goshawk, golden eagle, flammulated owl, burrowing owl, Vaux's swift, Lewis' woodpecker, white-headed woodpecker, black-backed woodpecker, pileated woodpecker, sage thrasher, loggerhead shrike, sage sparrow, sagebrush lizard, western toad, Columbia spotted frog, bull trout, leopard dace, and silver-bordered fritillary.
- Additional information is needed on abundance of American badger, pygmy horned lizard, and western ridged mussel.
- Information is needed on habitat associations, demography, food habits, or other aspects of ecology of lynx, American badger, fisher, great gray owl, Lewis' woodpecker, pileated woodpecker, loggerhead shrike, sage sparrow, California floater, winged floater, Oregon floater, and western ridged mussel.

- Additional distributional data are needed for American badger, white-headed woodpecker, pygmy nuthatch, pygmy horned lizard, sagebrush lizard, western toad, bull trout, California floater, winged floater, Oregon floater, and western ridged mussel.
- Information is needed on the causes of decline for American badger, white-tailed jackrabbit, western toad, subarctic darter, boreal whiteface, and subarctic bluet.
- Conservation needs of northern leopard frog are poorly understood.
- Impacts of various land use practices are not understood for sage thrasher and Columbia spotted frog.
- Better information is needed on the amount of gene flow among bull trout populations.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

Habitat loss, conversion, fragmentation and degradation:

- Only 15% of eastern Washington forest is currently in the old growth age class and nearly all of it is in high elevation national forests or national parks. Maintenance of old growth forest across the landscape is important for at least 1,000 species.
- Loss and fragmentation of late-successional coniferous forests negatively impacts fisher, northern goshawk, white-headed woodpecker, and pileated woodpecker.
- Conversion of forests for residential and commercial development eliminates habitat for western gray squirrel, northern goshawk, Lewis' woodpecker, and pygmy nuthatch.
- Forest loss due to timber harvest and fires may eliminate habitat for western gray squirrel, lynx, great gray owl, and Lewis' woodpecker.
- Loss and fragmentation of shrub-steppe and other more open habitats due to agriculture and development may harm populations of Townsend's big-eared bat, American badger, white-tailed jackrabbit, prairie falcon, sharp-tailed grouse, burrowing owl, sage thrasher, loggerhead shrike, sage sparrow, pygmy horned lizard, and sagebrush lizard.
- Degradation of shrub-steppe and other open habitats by improperly managed grazing and wildfire reduces habitat quality for white-tailed jackrabbit, prairie falcon, sharp-tailed grouse, sage thrasher, loggerhead shrike, and sage sparrow.
- Shoreline timber harvest and development may destroy nesting, foraging, or roosting sites for common loon, great blue heron, and bald eagle.
- Continued loss and degradation of shallow wetlands, wet meadows, bogs, and adjacent upland areas because of changing land use eliminates habitat for trumpeter swan, northern pintail, redhead, greater sandhill crane, and silver-bordered fritillary.
- Reclamation of abandoned mines may destroy critical maternity roosts and hibernacula for Townsend's big-eared bat.
- Bald eagle, golden eagle, prairie falcon, and gray wolf suffer from prey declines linked to habitat loss, degradation, and fragmentation.
- Sedimentation of aquatic environments eliminates habitat for California floater, winged floater, Oregon floater, and western ridged mussel.
- Degradation of streams and rivers due to inappropriate forest management and agricultural practices and human development is harmful to bull trout.
- Suburban sprawl is a concern for resource managers, as indicated by the growing number of ranchettes and residential subdivisions in previous managed forest and

cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.

Incompatible land management practices:

- Various timber harvest, snag removal, and replanting practices have degraded or eliminated habitat for a variety of species, including lynx, bald eagle, flammulated owl, great gray owl, Lewis' woodpecker, Vaux's swift, black-backed woodpecker, pileated woodpecker, and pygmy nuthatch.
- Flammulated owls experience declining food availability after the application of forest pesticides that kills non-target moths.
- Improperly managed grazing has degraded open ponderosa pine forests for Lewis' woodpecker and pygmy nuthatch.
- Fire suppression has degraded open ponderosa pine forests and other coniferous forests used by Lewis' woodpecker and black-backed woodpecker.
- Changes in fire regimes reduce the quality of nest sites and availability of food for pygmy nuthatches.
- Modern agricultural practices often reduce the quality, patch size and connectivity of wildlife habitat in farmlands.

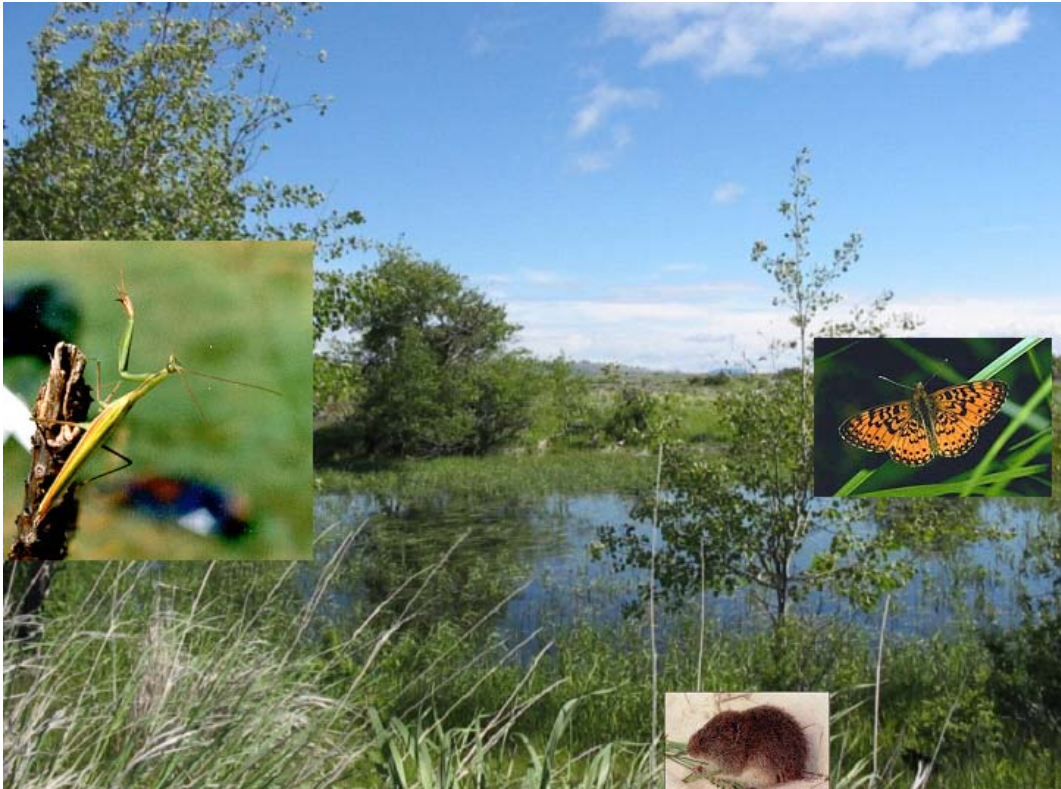
Alien and invasive plant and animal species:

- Reed canary grass thrives in reservoirs and wetland stream outlets where water levels fluctuate and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other animals are not well adapted to spawn or reproduce in reed canary grass thickets.
- Non-native fox squirrels potentially compete with western gray squirrels.
- European starlings compete with Lewis' woodpecker for nest cavities.
- Competition from introduced clams such as the Asian clam and other aquatic invaders affects California floater, winged floater, and Oregon floater.
- Shrub-steppe degradation through cheatgrass invasion and resulting increases in fire frequency negatively impacts sage thrasher, sage sparrow, and sagebrush lizard.
- Predation by introduced bullfrogs, bass, and other fish negatively impacts tiger salamander, northern leopard frog, Columbia spotted frog, and pygmy whitefish.
- Introduced carp and mosquitofish degrade habitat for northern leopard frog and Columbia spotted frog.
- Non-native fish, such as brook trout and rainbow trout, pose a threat to bull trout and westslope cutthroat through competition, hybridization, and predation.

Human disturbance and recreational impacts:

- Backcountry recreation such as motorized vehicles, hiking, and skiing may disturb or displace grizzly bear, wolverine, lynx, golden eagle, and peregrine falcon.
- Recreational boating and fishing may disturb or displace nesting or foraging birds, including common loon, western grebe, great blue heron, redhead, and bald eagle.
- Human disturbance and vandalism may disrupt the maternity roosts and hibernacula of Townsend's big-eared bat located in caves and mines.
- Encroachment of human development can force golden eagle, prairie falcon, and greater sandhill crane from suitable nesting sites.
- Nesting peregrine falcons are vulnerable to disturbance from human activities, such as blasting and timber cutting.
- Mowing may accidentally destroy the nests and chicks of greater sandhill crane.

- Recreational activities such as off-road recreational vehicles, horses, mountain bikes, and even hikers can create unauthorized trails that disturb soil and allow invasive plants to establish.
- The nature and timing of agricultural practices may be increasingly hazardous to wildlife. Tilling, planting and harvesting are becoming more synchronous, widespread and intense, thus stressing wildlife during critical periods of nesting, rearing and dispersal.



Environmental contaminants:

- Ingestion of lead fishing sinkers by common loons and lead shot by bald eagle and golden eagle results in lead poisoning.
- Contamination from agricultural chemicals, mercury, or other pollutants and associated declines in prey are harmful to American white pelican, burrowing owl, sage thrasher, northern leopard frog, California floater, winged floater, Oregon floater, and western ridged mussel.
- Piscicides such as rotenone used for eliminating undesirable fish species from lakes and streams also kill pygmy whitefish.

Incompatible transportation and energy development:

- Large highway corridors (including Highways 20, 21, 97, and 395) and associated development fragment suitable habitat and create barriers or impediments to movement for gray wolf, wolverine, and lynx.
- Roads may facilitate winter competition between lynx and coyote.
- Roads placed near great blue heron rookeries may result in site abandonment.
- Roads located near breeding sites cause highway mortality in western toad.

- Golden eagle and other raptors can be electrocuted on power lines.
- Development of wind energy projects may be harmful to sharp-tailed grouse.

Inadequate water quantity and quality:

- Altered hydrology eliminates habitat for Columbia spotted frog and inland redband trout.
- Fluctuating water levels caused by dams may hurt the survival and reproduction of California floater, winged floater, and Oregon floater.
- Fluctuating water levels in wet meadows caused by drainage and damming projects may reduce the breeding success of greater sandhill crane.
- Increased water temperature and sedimentation caused by logging, agriculture and other activities may harm inland redband trout and pygmy whitefish.
- Declining beaver populations in some areas and the subsequent loss of beaver ponds has reduced habitat for Columbia spotted frog.
- Dams and other passage barriers limit the movement of bull trout.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protect known populations, augment and reintroduce populations, control and monitor mortality and enhance food/prey.

- Implement recovery actions for grizzly bear, gray wolf, lynx, greater sandhill crane, and bull trout.
- Prepare or finalize recovery plans for northern leopard frog and bull trout.
- Develop management plans for state sensitive species, including common loon, peregrine falcon, and pygmy whitefish.
- Complete the Washington Bat Conservation Plan.
- Prepare interagency management response guidelines for gray wolf to document sightings and address conflicts.
- Reduce potential mortality in grizzly bear from accidental shooting by conducting programs to educate bear hunters on proper identification of black bear and grizzly bear.
- Develop habitat management recommendations for the silver-bordered fritillary.
- Continue translocations of sharp-tailed grouse to increase population size.
- Conduct translocations of western gray squirrel, white-tailed jackrabbit, fisher, northern leopard frog, California floater, winged floater, Oregon floater, and western ridged mussel into areas of appropriate habitat if indicated by recovery plans and feasibility studies.
- Implement salmon recovery strategies to enhance the prey base for bald eagle.
- Establish and implement fisheries management objectives that are compatible with bull trout recovery.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat and population trends.

- Determine the status of candidate species, including Townsend's big-eared bat, white-tailed jackrabbit, wolverine, western grebe, northern goshawk, golden eagle, flammulated owl, burrowing owl, Vaux's swift, Lewis' woodpecker, white-headed woodpecker, black-backed woodpecker, pileated woodpecker, sage thrasher, loggerhead shrike, sage sparrow, sagebrush lizard, western toad, Columbia spotted frog, bull trout, leopard dace, and silver-bordered fritillary.
- Monitor the abundance of Townsend's big-eared bat, American badger, northern goshawk, pygmy horned lizard, sagebrush lizard, Columbia spotted frog, pygmy whitefish, leopard dace, silver-bordered fritillary, subarctic darter, boreal whiteface, subarctic bluet, California floater, winged floater, Oregon floater, and western ridged mussel.
- Monitor populations of lynx, western gray squirrel, gray wolf, grizzly bear, fisher, sharp-tailed grouse, greater sandhill crane, American white pelican, northern leopard frog, and bull trout to determine whether recovery objectives are being met.
- Monitor bald eagle and peregrine falcon populations to watch for declines that may indicate new contaminant problems.
- Seek and evaluate reports of incidental sightings of grizzly bear and gray wolf.
- Gather distribution data on Townsend's big-eared bat, white-tailed jackrabbit, pygmy nuthatch, pygmy horned lizard, sagebrush lizard, western toad, northern leopard frog, Columbia spotted frog, bull trout, leopard dace, subarctic darter, boreal whiteface, subarctic bluet and western ridged mussel.
- Identify roost sites and hibernacula of Townsend's big-eared bat.

- Conduct habitat selection studies at multiple spatial scales for flammulated owl, great gray owl, Vaux's swift, Lewis' woodpecker, white-headed woodpecker, black-backed woodpecker, and Columbia spotted frog.
- Investigate use of shrub-steppe patches in landscapes of differing patchiness and connectivity to design conservation strategies for sage thrasher, loggerhead shrike, and sage sparrow.
- Evaluate the population demography or other aspects of the life history of flammulated owl, Lewis' woodpecker, California floater, winged floater, Oregon floater, and western ridged mussel.
- Track habitat availability for western gray squirrel, American badger, black-backed woodpecker, California floater, winged floater, and Oregon floater using remote sensing or other appropriate techniques.
- Develop survey protocols to monitor the abundance of great blue herons, white-tailed jackrabbits, and **American badger**.
- Evaluate whether existing forest management prescriptions are adequate to maintain populations of lynx and pileated woodpecker.
- Evaluate habitat suitability and develop habitat management recommendations for northern leopard frog.
- Monitor the expansion of West Nile Virus into areas occupied by sharp-tailed grouse.
- Monitor any colonizing wolves to determine establishment of packs and habitat use.
- Investigate the limiting factors and causes of decline among populations of white-tailed jackrabbit, American badger, subarctic darter, boreal whiteface, and subarctic bluet.
- Determine the amount of genetic diversity and gene flow among bull trout populations.
- Investigate the taxonomy of western toad, California floater, winged floater, Oregon floater, and western ridged mussel using genetic techniques and other analyses.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update ecoregional assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.



Protect, restore and connect habitats:

- Maintain mature and late-successional coniferous forests from harvest to protect fisher, northern goshawk, flammulated owl, Vaux's swift and black-backed woodpecker.
- Develop a conservation strategy that addresses management of pine and other coniferous forests, including maintaining and recruiting suitable snags as nesting sites for great gray owl and white-headed woodpecker.
- Provide input on timber harvest and fire management activities on state, private, and federal lands to perpetuate adequate amounts and distribution of denning and foraging habitats for lynx.
- Protect forests with concentrations of western gray squirrel nests from timber harvest and provide protective buffers around trees with nests.
- Maintain and restore open ponderosa pine forests to enhance populations of golden eagle, Lewis' woodpecker, and pygmy nuthatch.
- Maintain and restore mature cottonwood riparian forests with large diameter snags for Lewis' woodpecker.
- Work with county planners to establish reserve areas of open forests and woody riparian corridors for Lewis' woodpecker.
- Maintain and restore important areas of shrub-steppe and native grasslands, restore ecological functions of degraded areas, and protect important sites through acquisitions, easements, and agreements to protect white-tailed jackrabbit, prairie falcon, burrowing owl, loggerhead shrike, sage thrasher, pygmy horned lizard, and sagebrush lizard.
- Protect and enhance meadow-steppe, riparian habitats, and deciduous forests, including the restoration of low elevation wintering sites, for sharp-tailed grouse.
- Protect and restore riparian areas for inland redband trout and bull trout.
- Protect important roost sites and hibernacula used by Townsend's big-eared bat.
- Protect suitable breeding lakes for common loon and redhead from development and recreational pressure.
- Protect ponds, lakes, creeks, bogs, wetlands and their margins, and adjoining areas of steppe and ponderosa pine used by tiger salamander, Columbia spotted frog, subarctic darter, boreal whiteface, and subarctic bluet.
- Protect land near large great blue heron colonies and greater sandhill crane nesting sites through acquisitions, conservation easements and agreements and management plans.
- Preserve wintering habitat for trumpeter swan, northern pintail, and redhead on agricultural lands and wetlands through land purchase, conservation easements, and management programs.
- Protect important areas of ungulate winter range through acquisitions, easements, and agreements to provide adequate prey populations for gray wolf.
- Conserve prey populations of golden eagle, prairie falcon, and burrowing owl by reducing deliberate control programs.
- Manage small fish populations in lakes with nesting common loon.
- Maintain and enforce Forest Practice rules protecting bald eagle roost sites and nests.
- Continue to require bald eagle habitat plans that require retention of trees.
- Reduce sedimentation of aquatic habitats used by California floater, winged floater, Oregon floater, and western ridged mussel.
- Protect rare habitat types such as aspen stands, snag patches, caves, cliffs, and talus.

- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas, and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented, or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers and estuaries.
- Work with public and private landowners to reestablish and restore native shrub-steppe and grassland plant communities in selected public and private habitat areas to support species at risk and increase species richness.

Improve land management practices:

General

- Restore degraded ponderosa pine forests by thinning dense understory fir, encouraging longer harvest rotations, returning to natural fire regimes, and maintaining snags to enhance populations of northern goshawk, flammulated owl, Lewis' woodpecker, and pygmy nuthatch.
- Promote forest management practices that improve habitat connectivity and facilitate dispersal for grizzly bear, gray wolf, wolverine, and lynx.
- Allow wildfires to burn in some forests to create suitable habitat for black-backed woodpecker.
- Exclude cattle from grazing in riparian forests to protect habitat for Lewis' woodpecker.
- Manage land use activities in riparian areas used by inland redband trout.
- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Fire management

- Work with public agencies and private landowners to reduce the potential destructive impact of wildfires on native habitats by incorporating measures such as fire breaks and prescribed burning into wildlife and land management plans.
- Coordinate with public land managers on the use of controlled fire regimens and stand management practices. Attempt to simulate natural disturbance regime and restore proper ecological function. Consider impacts to local wildlife in each burn plan, including timing, size and location of the burn.

Forest management

- Protect remaining old growth conifer and hardwood stands to benefit late successional species, and manage some stands on long rotations (>200 years).
- Work with the Washington Department of Natural Resources and the Washington Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the State Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem function. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions. Retain snags, downed woody debris and a complement of live trees in harvested areas. Sensitive areas such as wetlands, remnant old growth and wildlife breeding sites should not be disturbed.
- Encourage the development of selective harvest policies and guidelines on both public and private forestland that will leave adequate components of old growth habitat such as snags and downed wood as habitat for associated wildlife such as northern goshawk, Vaux's swift, flammulated owl, Lewis' woodpecker, black-backed woodpecker, pileated woodpecker, and **pygmy nuthatch**.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Support implementation and enforcement of the Washington Forest Practices Act to accomplish habitat conservation and regeneration on both state and private forestlands.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.



Grazing and agricultural practices

- Work with public and tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland and shrub-steppe understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use, grazing and soil erosion.
- Ensure that grazing leases on state lands comply with HB1309 "Ecosystem Management Standards" to maintain fish and wildlife habitat.

Control and prevent introduction of alien and invasive species:

- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Control the spread of cheatgrass in shrub-steppe to prevent the degradation of habitat for sage thrasher, sage sparrow, and sagebrush lizard.
- Develop methods to control or otherwise mitigate impacts of introduced bullfrogs and fish on northern leopard frog and Columbia spotted frog.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout, westslope cutthroat trout, native amphibians and reptiles; avoid introduction of rainbow trout or only introduce sterile fish where westslope cutthroat are found. Avoid introduction of non-native trout to protect bull trout from hybridization, competition, and predation.
- Monitor lakes, streams and wetlands for illegal fish introductions and prohibit legal introductions to protect tiger salamander, northern leopard frog, Columbia spotted frog, and pygmy whitefish.
- Control fox squirrels over limited areas as needed to benefit western gray squirrels.
- Determine extent of competition for cavities between Lewis' woodpecker and European starling and, if necessary, control starlings.
- Control and monitor the introductions of non-native bivalves and other aquatic invasives through enforcement and education to protect California floater, winged floater, and Oregon floater.
- Conduct genetic work to determine the extent of hybridization between native and non-native subspecies of tiger salamander and, if necessary, prohibit the use of non-native subspecies as fishing bait.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and

coordination of weed control efforts on both public and private lands using environmentally sound methods.

- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.

Control and monitor disturbance:

- Limit disruptive types of recreational activity in roadless, wilderness, and primitive areas to prevent disturbance of grizzly bear and wolverine.
- Limit access to roost sites and hibernacula used by Townsend's big-eared bat.
- Minimize disturbance of great blue heron, bald eagle, **golden eagle**, prairie falcon, and peregrine falcon nests from human activities such as development, logging, boating, and other recreational activity by restricting access to public lands as needed, working with permitting agencies to reduce levels of disturbance, and informing the public of sensitive areas and periods.
- Establish wake-free zones near breeding colonies of western grebe to minimize boater disturbance.
- Prevent construction of roads and buildings within ½ mile of greater sandhill crane territories and discourage detrimental mowing practices during sensitive nesting periods.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats such as montane wetlands, bogs, prairies, and dunes.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.
- Protect nesting golden eagle, bald eagle, peregrine falcon and prairie falcon through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting; inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrine, golden eagle, and prairie falcon.



Control and prevent environmental contamination:

- Protect common loon, bald eagle, and golden eagle from lead poisoning by advocating the use of non-toxic fishing sinkers and steel shot.
- Evaluate the need for contaminant studies in northern leopard frogs.

- Restrict the use of piscicides such as rotenone in waters with common loon and pygmy whitefish.
- Work with other agencies to decrease and remediate sources of contamination to protect bald eagle, peregrine falcon, California floater, winged floater, Oregon floater, and western ridged mussel.
- Prohibit spraying of toxic chemicals near the burrows of burrowing owls and monitor compliance.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments whenever possible, and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Continue to place a priority on actions to prevent and respond to oil and hazardous material spills.

Improve transportation and energy development:

- Power lines near breeding and foraging areas should be built or modified to reduce the occurrence of golden eagle and other raptor electrocutions.
- Prohibit construction of wind energy projects in areas important for sharp-tailed grouse.
- Highway overpasses/underpasses should be constructed to facilitate access to suitable habitats for grizzly bear, gray wolf, and wolverine.
- Reduce road mortality in western toad by providing road crossings near breeding sites.
- Avoid road building near breeding sites for ***western toad***.
- Work with the Washington Department of Transportation to locate highways away from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife, such as western toads, that need passage.



Improve water quantity and quality:

- Provide floating nest platforms for common loon at lakes with fluctuating water levels.
- Conserve beaver populations, beaver ponds, and dynamic stream processes in areas with Columbia spotted frog.
- Reduce the impacts of land use practices that increase water temperature and sedimentation, thereby harming inland redband trout and pygmy whitefish.
- Improve water quality at potential northern leopard frog recovery areas.

- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as conserving beaver populations and dynamic stream processes, to benefit species such as tiger salamander, northern leopard frog, Columbia spotted frog, and silver-bordered fritillary.
- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts, or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.

Improve coordination, planning, permitting and mitigation:

- Strengthen the Shoreline Management Act to protect bald eagle nesting and roosting sites.
- Develop a critical habitat rule and work with counties to conserve habitat for western gray squirrel.
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation, as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, Shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.

- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.
- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Assist federal agencies in implementing the Interior Columbia Basin Ecosystem Management Strategy.
- Represent WDFW's conservation interest on interagency recovery teams and working groups.

Improve enforcement of laws and regulations:

- Enforce existing protections for grizzly bear, gray wolf, and bald eagle through vigorous investigation and prosecution.
- Enforce fishing regulations, seasons, and stream closures to protect bull trout from fishing pressure.
- Maintain conservative hunting regulations for northern pintail and redhead.
- Enforce recreational access restrictions on public lands and aquatic areas.

Improve landowner assistance:

- Work with landowners to maintain sufficient foraging habitat, travel corridors, and denning sites for lynx.
- Develop, periodically update, and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.
- Work with large and small timber companies and landowners to accomplish habitat conservation through non-regulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity and protect these areas through landowner incentives and other nonregulatory programs. This would assist species such as great blue heron, trumpeter swan, northern pintail, redhead, bald eagle, flammulated owl, Vaux's swift, Lewis' woodpecker, pileated woodpecker, pygmy nuthatch, sage thrasher, loggerhead shrike, sage sparrow, pygmy horned lizard, sagebrush lizard, western toad, northern leopard frog, Columbia spotted frog, and silver-bordered fritillary.
- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife, and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.

- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands, shrub-steppe and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Conduct outreach and education programs to engage the public in conservation programs for many species, including gray wolf and grizzly bear.
- Continue volunteer programs for monitoring common loon activity at lakes.
- Education programs are needed to curtail recreational pressure on common loons and redheads at suitable breeding lakes.
- Discourage the capture of pygmy horned lizards as pets.
- Discourage the capture of larval tiger salamanders as fish bait.
- Provide educational materials to hunters to prevent accidental mortality and harassment of lynx.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.
- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.



Greater sandhill cranes.